The Effects of Temperature on the Abundance of Blue Mussel Beds (*Mytilus edulis*) in the Barnegat Inlet

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Abstract

The purpose of this study was to determine the effect of temperature on the abundance of *Mytilus edulis* in the mussel bed at Barnegat Inlet, New Jersey. This was accomplished by estimating the percent live mussel cover in the bed, while closely monitoring water temperature at the bed. The data showed a negative correlation between temperature and percent mussel cover indicating that water temperature may be linked with mortality at the beds. Also, the largest mussel lengths at the bed decreased with increasing temperature. Temperature may stress the mussels to only live for short periods of time and this type of existence triggers larger mussels to die more often than the smaller mussels (Seed and Suchanek, 1992). Also, past 25ºC, mussel growth rates have been known to decline so the surviving mussels may not grow to be very large once water temperature hits 25ºC, and the bed may appear to 'shrink (Brenko and Calabrese, 1969). Lastly, the number of starfish present within the quadrat and the salinity at each site was plotted against percent mussel cover. The correlation between the number of starfish and salinity against percent mussel cover is weaker than the correlation between temperature and percent mussel cover. Thus temperature may have a stronger link with mussel mortality than these other factors.

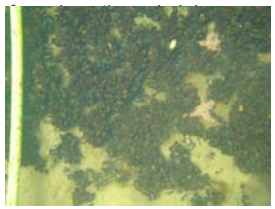
Introduction

The blue mussel, *Mytilus edulis,* has both commercial value for human consumption and ecological value as an indicator species of water quality (Gosling, 1992). Although these mussels can survive freezing temperatures, they often die-off rapidly in the summer months when water temperature rises (Gosling, 1992; Tremblay et al., 1998). While many factors may account for the mass mortality of *Mytilus edulis*, temperature is often a key factor (Tremblay et al., 1998).This study looked at the correlation between temperature and mussel mortality at a mussel bed located at Barnegat inlet to observe the strength of the relationship between temperature and mussel mortality.

Methods

Sampling was conducted using a 23-foot Carolina Skiff. Once the mussel bed was located, its position was permanently saved using a Garmin GPS unit to locate in future samples. Metric measurements of shell lengths were recorded on a random sample of mussels at each site.

Once a week, the mussel bed was sampled with a 0.25-sq m quadrat. The quadrat was haphazardly thrown multiple times at several locations within the mussel bed in order to determine the percent cover of mussels on the estuarine bottom. The percent cover of mussels was then estimated in-situ by a diver who visually inspected the quadrat in the mussel bed. In addition, a 6-series datalogger was used to record temperatures at the mussel bed. This entire process was repeated over an approximately eight week period



Areal photograph of *Mytilus edulis* and predatory starfish at the channel sbed at Barnegat inlet, NJ

Results

Temperature vs Percent Mussel Cover

A negative relationship was found between percent mussel cover at the bed and temperature at the bed as shown in Figure 1 (below). As the water temperature increased, the areal coverage of mussels in the bed decreased.

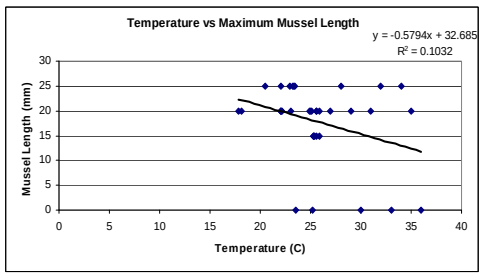


Figure 1. Temperature plotted against percent mussel cover at the mussel bed at Barnegat Inlet and an inverse relationship was found.

Results Continued

Maximum Mussel Length vs Temperature:

As shown below in Figure 2, there was a negative correlation between temperature and the maximum mussel length.

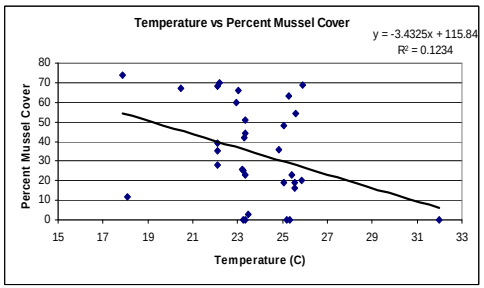


Figure 2. Comparison of temperature against maximum mussel length showing a negative trend.

Other Factors vs Percent Mussel Cover

The number of starfish present and the salinity in the bed were also measured, as shown below in Figure 3. The correlation between these two factors and percent cover was lower than when percent mussel cover was correlated to temperature (see Figure 1).

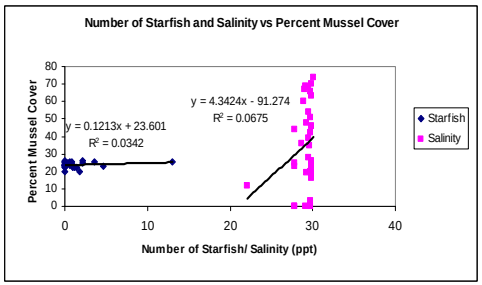


Figure 3. Comparison of the number of starfish and salinity against percent mussel cover at the study site.

Conclusion

Laboratory experiments on *M. edulis* have shown that above 30ºC both filtration rate and heart rate of *M. edulis* decline sharply (Schulte, 1975; Widdows, 1973). Results of this study show that elevated temperature causes a reduction in growth of *M. edulis* and may contribute to higher mortality. As shown in Figure 1, the percent cover of mussels in the bed also decreases as temperature increases.

The mussels at the inlet appear to grow and die quickly. After settlement on the estuary bottom, they grew several millimeters in length from week to week. Few mussels grew larger than 30mm in length and the smaller individuals appear to have greater survival than the larger individuals as supported by previous work (Seed and Suchanek, 1992). Mussels larger than 20mm in length may be less tolerant of elevated temperatures than smaller members of the population. In addition, above 25ºC growth rates of *Mytilus edulis* tend to decline, so that the small mussels may not grow quickly enough to replace large mussels that died (Brenko and Calabrese, 1969).

Lastly, the correlation between temperature and percent mussel cover is higher than when the number of starfish and salinity are both plotted against percent mussel cover in Figure 3. This appears to show that temperature has a greater effect on the survival of mussels at the inlet than do starfish and salinity.

Acknowledgements

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