TEMPORAL AND SPATIAL VARIABILITY

TUNICATE RECRUITMENT IN A TEMPERATE FOULING COMMUNITY

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Abstract

Settlement among native and invasive tunicates in fouling communities were observed at weekly intervals at Pillar Point Harbor in Half Moon Bay, California. Because tunicates are filter feeding organisms we hypothesize their settling rates will be dependent on flow rates. Settlement plates and plaster dissolution module plates (clods) were used to quantify flow and settlement variation from 7/9/11-8/7/11 using high resolution field microscopy. Three genera of colonial tunicates (*Botrylloides sp., Didemnum vexillum,* and *Distaplia sp.)* along with two solitary tunicates *Ascidia sp., Ciona sp.,* and a bryozoan *Watersipora sp.* were quantified. Flow data was collected every 7 days from clod plates associated with each settlement array. Results showed no significant evidence that local measures of flow were predictive of settlement rates. However, anecdotal observations showed a significant decrease in settlement rate associated with a temperature warming event, increased algal growth, and presence of predators on plates.

Introduction & Theory

Invasive tunicates are an expensive nuisance because they foul aquaculture gear, mussel lines, buoys, boat hulls, piers, and other artificial substrates. Nearly all tunicates are sessile organisms that obtain all their nutrients needed for life by filtering particles out of the water. Thus, flow is paramount for survival of tunicates and differences in flow could produce differences in settling rates and survival. In this study, we tested to see if settling rates were dependent on flow rate, and in particular whether low flow conditions are associated with lower amounts of recruitment. Understanding the relationship between flow and settling rates could ultimately help in management efforts of these invasive species.

Materials & Equipment

- 20 grey PVC plates 6”x12”
- 18 grey PVC plates 6”x6”
- Bricks
- 1/4” nylon rope
- Plaster clods
- DinoXcope
- Digital Camera
- MacBook Pro

Methodology

Six settling plate arrays, each with a plate at 1m and at 3.5m depths were deployed at different locations at Pillar Point Marina, California, USA. These plates were deployed for 4 weeks starting on July 9, 2011. Temperature was measured using a hobo logger for the duration of the experiment. Plaster clods were also placed at each location. The clods were placed in the field for 7 days and dissolution was used to determine relative water flow rate using ANOVA. This was repeated 4 times.

Clod Plates

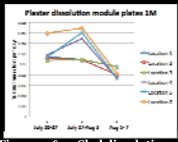
Hobo Temperature logger

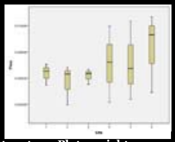
Field data recording setup

DinoXcope

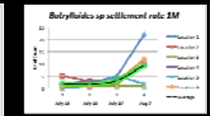
Settling plate models

Results





Figures 1 & 2, Clod dissolution rates at 1m. Plot on right shows means and standard deviations.



Figures 3 & 4, *Botrylloides sp.* (pictured below left) Settlement rate at 1m and 3.5 m

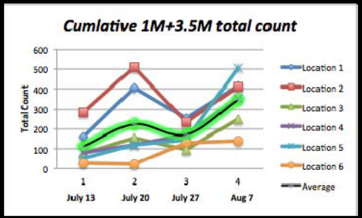
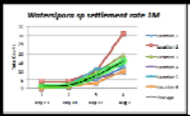
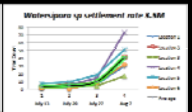


Figure 7, Cumulative 1m + 3.5 m total count

Botrylloides sp.

Watersipora sp.





Figures 5 & 6, *Watersipora sp.* (pictured above right) Settlement rate at 1m and 3.5 m

Figure 1 shows differences in flow conditions throughout the study. These differences are shown in figure 2 where there was no significant difference in the flow rates across the 6 locations, despite large amounts of variation between and within sites. Figures 3-7 show a noticeable decrease in settlement between the second and third observation times. Between the third and fourth observation times, recruit numbers recover to the initial trends of weeks one and two. Figure 7 shows a warming trend of 4 degrees C beginning at 7/18 lasting until 8/3, then a gradual cooling until termination of the experiment. Figure 8 shows a large algal bloom during the third count and continued on the fourth count.

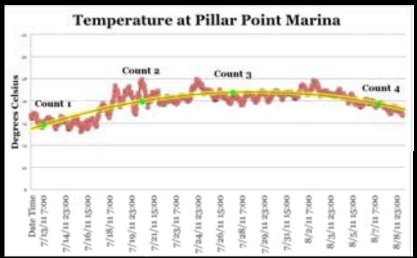


Figure 7, Temperature at Pillar Point Marina

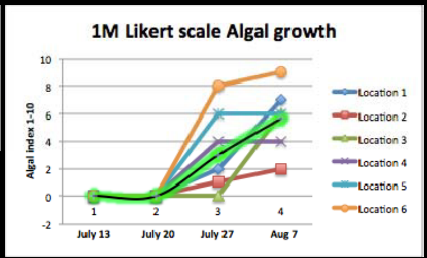


Figure 8, 1M Likert scale with algal growth 10 being the highest.

Conclusion

Settling rates were not found to be dependent on flow rate in this experiment. Clods showed high variance between replicates perhaps due to temporal differences in flow environments, or alternatively, batches may have lacked consistency. Additionally, settlement rates showed strong differences in time, location in the marina, and depth. However, temperature and algal growth on plates showed similar trends to settlement counts. Further, anecdotal observations showed heavy predation pressure may have a strong influence on settlement counts. From this evidence we now think settlement rates may be more dependent on temperature, predation, and competition with algae.

Future Work

A long term goal in invasive biology is to determine how to best manage the spread of non-native organisms. Based on preliminary and anecdotal findings, predators may have stronger influences on recruit success in comparison to flow effects. Dramatic declines in recruit counts show high mortality after settlement and observations of predator activity suggest a cause. Potential relationships between predator detection and settlement rates should be explored. Temperature variation appears to have a strong effect on recruits while algae appear to impede both growth of existing recruits and settlement. By examining these issues we may reach a better understanding of how to manage invasive tunicates.

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