Oyster Larval Dispersal and Recruitment in the Caloosahatchee River Estuary, Southwest Florida

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INTRODUCTION

The eastern oyster (*Crassostrea virginica*) is ecologically and economically important in estuaries along the coast of the Gulf of Mexico. Globally, oyster reef habitats have declined as much as eighty percent in the past 200 years[1]. Water circulation, temperature, salinity, available substrate, anthropogenic pollutants, and commercial fishing all have been identified as key stressors for oyster populations[2]. These stressors can be particularly damaging to the early life stages of oysters (i.e., larvae and newly settled spat) and affect the resilience of oyster reefs. The Caloosahatchee River Estuary (CRE) is a shallow, subtropical estuary in Southwest Florida and is home to both natural and artificial oyster reefs. Like other regions, oyster populations have declined over recent years, likely from an influx of freshwater into the CRE. To understand how oysters are affected by altered flow, a comprehensive field study was conducted to collect larval distribution and spat settlement data for the creation of a particle tracking model, which can accurately simulate larval transport throughout the CRE.

STUDY AREA

Figure 1. Eleven selected sites within the CRE:
- OL 0, 1: Caloosahatchee River
- OL 2, 3, 6: San Carlos Bay
- OL 4, 5: Matlacha Pass
- OL 7, 8, 9, 10: Pine Island Sound

BROADER IMPLICATIONS

- Understand the spatial and temporal variability of oyster larval settlement and correlate this variation with water quality parameters.
- Greater understanding to plan out where and when reef restoration projects would have the greatest success within the CRE.
- Advise water management to toward an ecosystem-based approach for water releases (specifically S-79 Franklin Lock & Dam).

METHODOLOGY

Figure 2. Spat collectors were deployed at 2-week intervals to capture oyster settlement. Each string consisted of 10 shells, which act as a natural substrate for the oyster spat. Inset shows newly settled oyster spat on a shell.

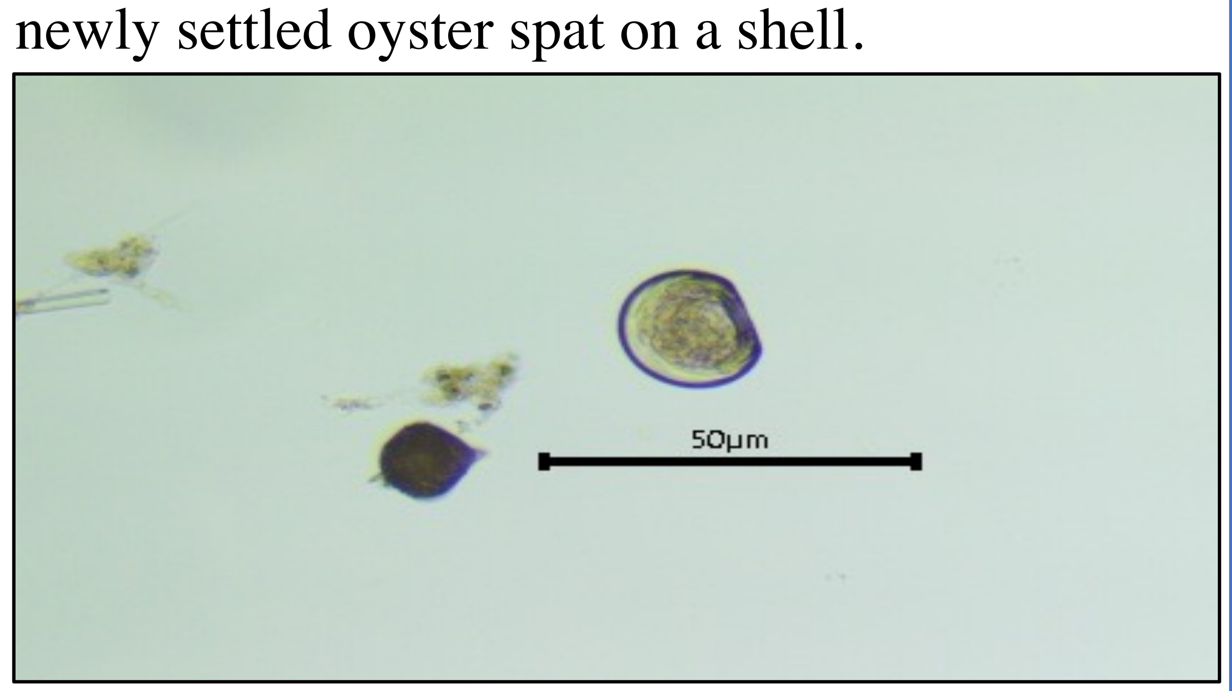

Figure 3. Plankton samples were sorted microscopically to count bivalve larvae filtered from 10 L samples. These counts were used to determine larval densities at each location throughout the spawning season.

REFERENCES

[1]Lotze et al. (2006). Depletion, degradation, and recovery potential of estuaries and coastal seas. *Science* 312, 273-289.
[2]Klinck *et al*. (2002). Impact of Channelization on Oyster Production: A Hydrodynamic-Oyster Population Model for Galveston Bay, Texas. *Environmental Modeling & Assessment* 7, 273–289.

RESULTS

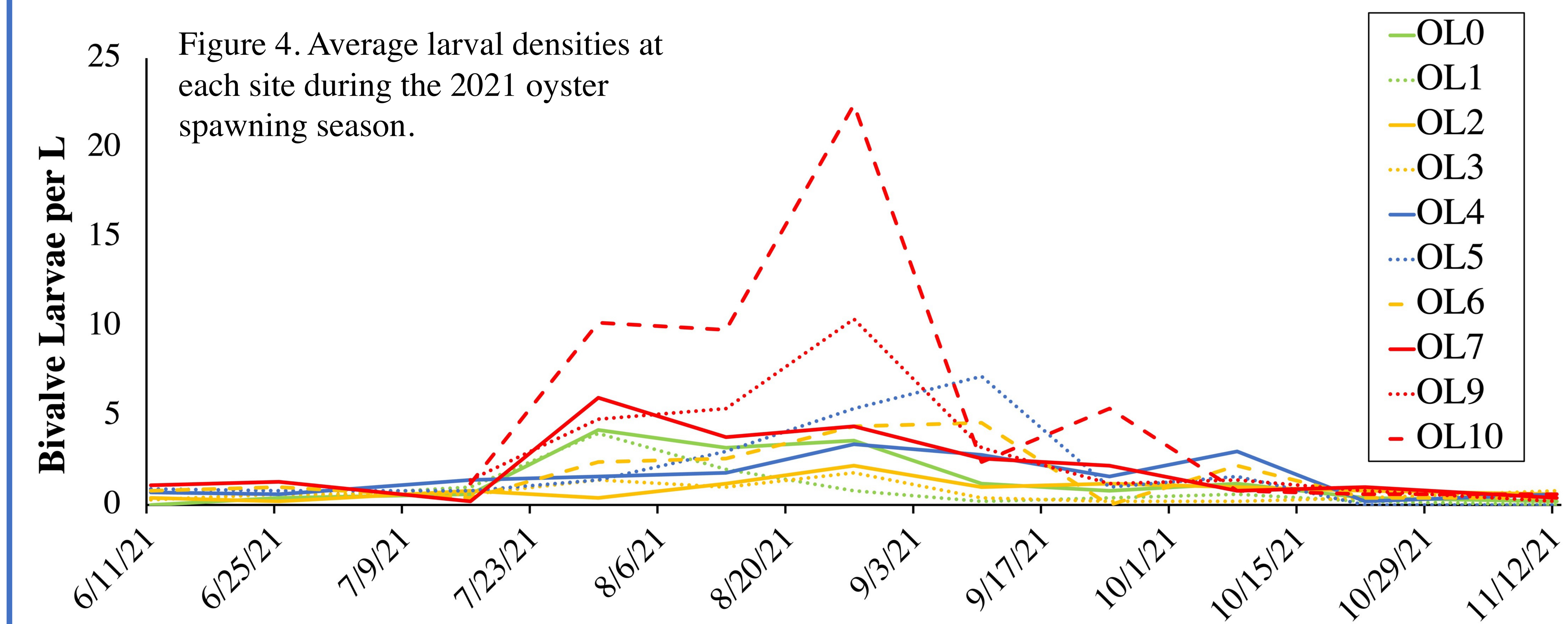

Figure 4. Average larval densities at each site during the 2021 oyster spawning season.

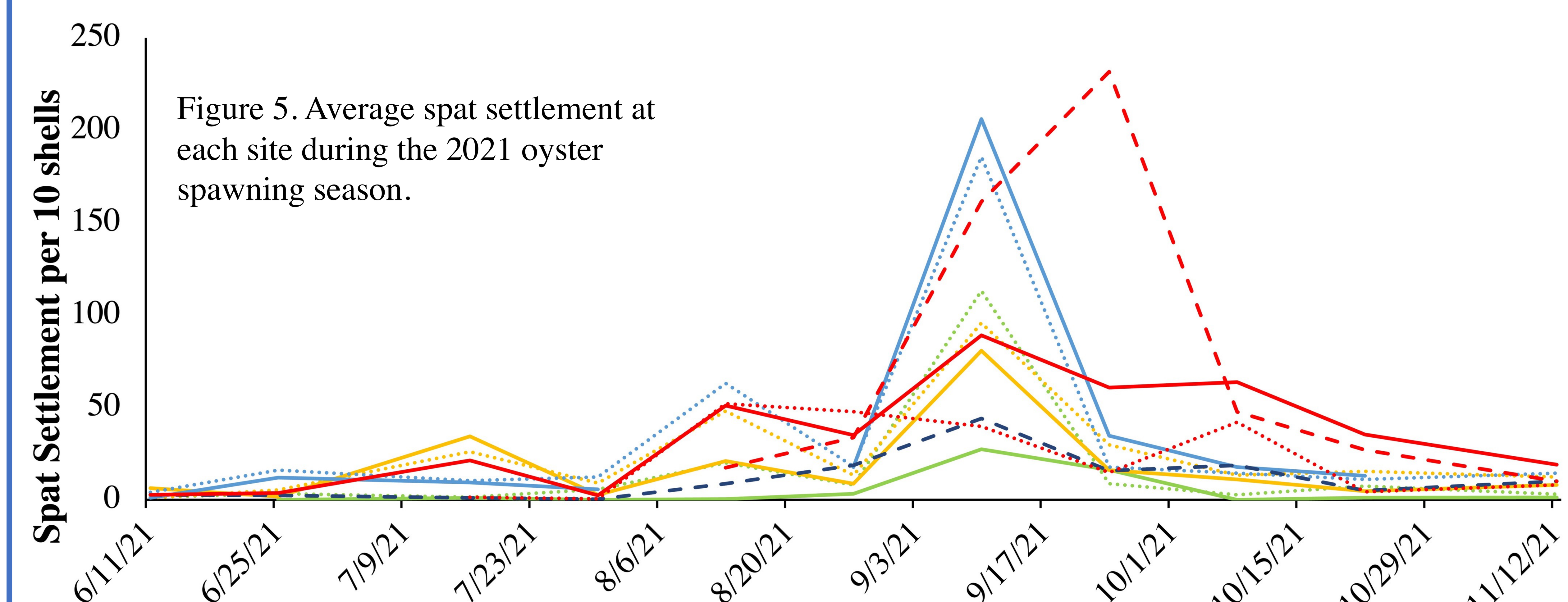

Figure 5. Average spat settlement at each site during the 2021 oyster spawning season.

CONCLUSIONS

1. **Larvae show variable spatial and temporal distributions in the CRE, with peak abundance in late Aug – early Sept.**
2. **Settlement peaks approximately 2-weeks after peak larval abundance, which is consistent with the oyster larval duration after spawning.**
3. **Matlacha Pass (OL 4, 5) and Pine Island Sound (OL 7-10) have higher larval supply and settlement than the riverine environments and San Carlos Bay.**
4. **These patterns are likely attributed to the variation of flow and salinity that corresponds with the wet season.**

FUTURE WORK

This data will be used to calibrate and validate a particle tracking model, which when conjoined with the hydrodynamic model, will result in an agent-based larval transport model for the CRE during 2020-2021. The output of this model will accurately depict larval transport throughout the entire CRE, and settlement will be interpreted.

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