ABSI Modeling

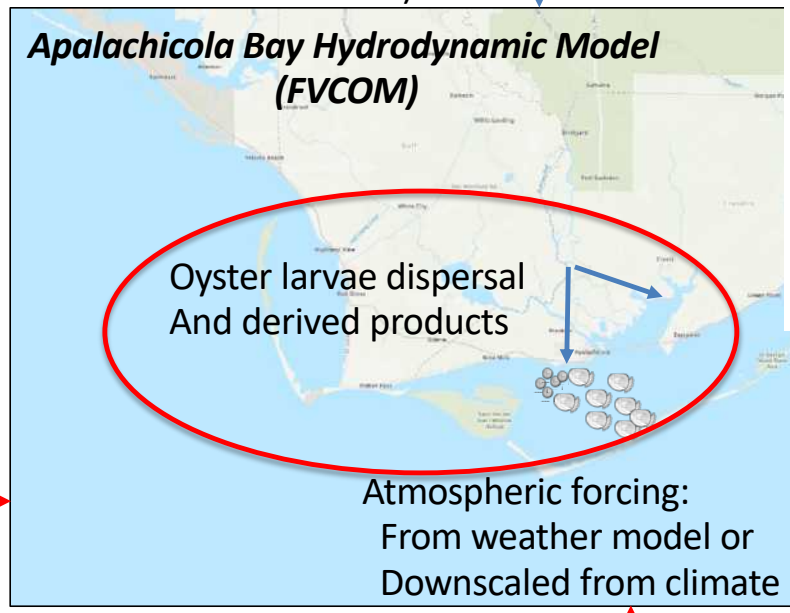
Hydrographic Modeling Update

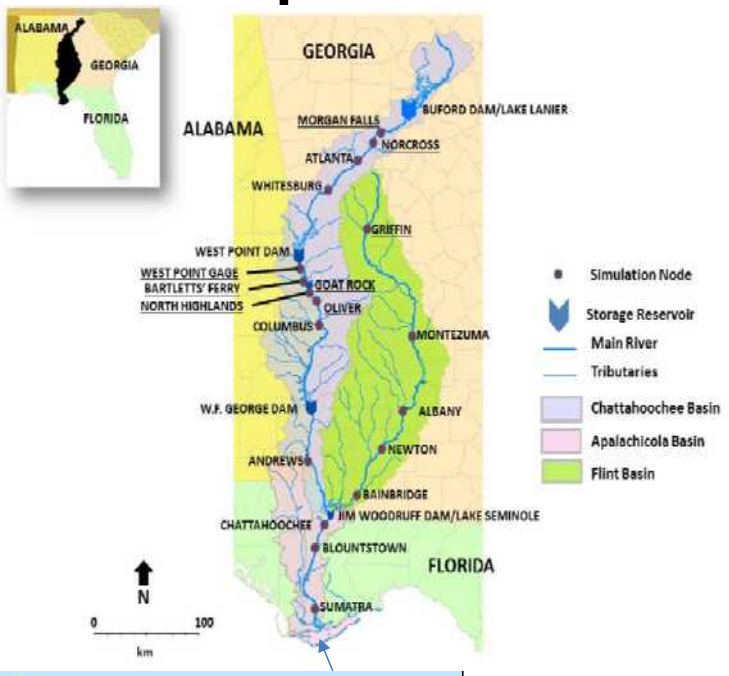
Dr. Steve Morey
Florida A&M University

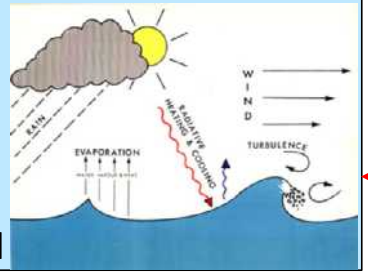
Dr. Xu Chen
Florida State University

ABSI Bio-Physical Model Concept

ACF watershed and
Apalachicola River distributary
flow from ACF STELLA Model
(Steve Leitman) and
downscaled FVCOM (Ken
Jones and UF Student)





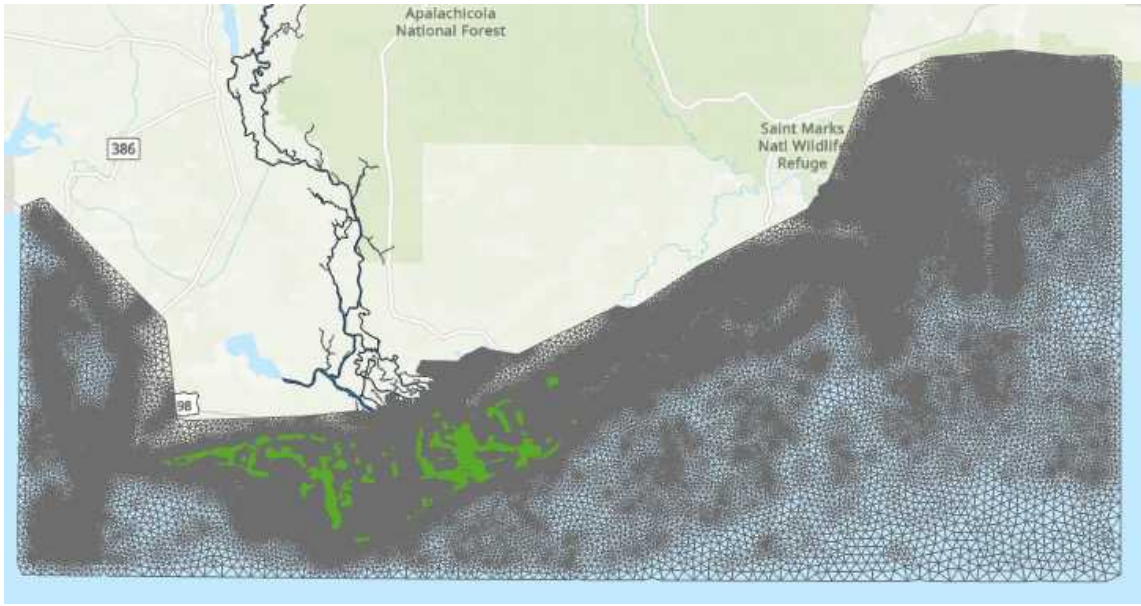


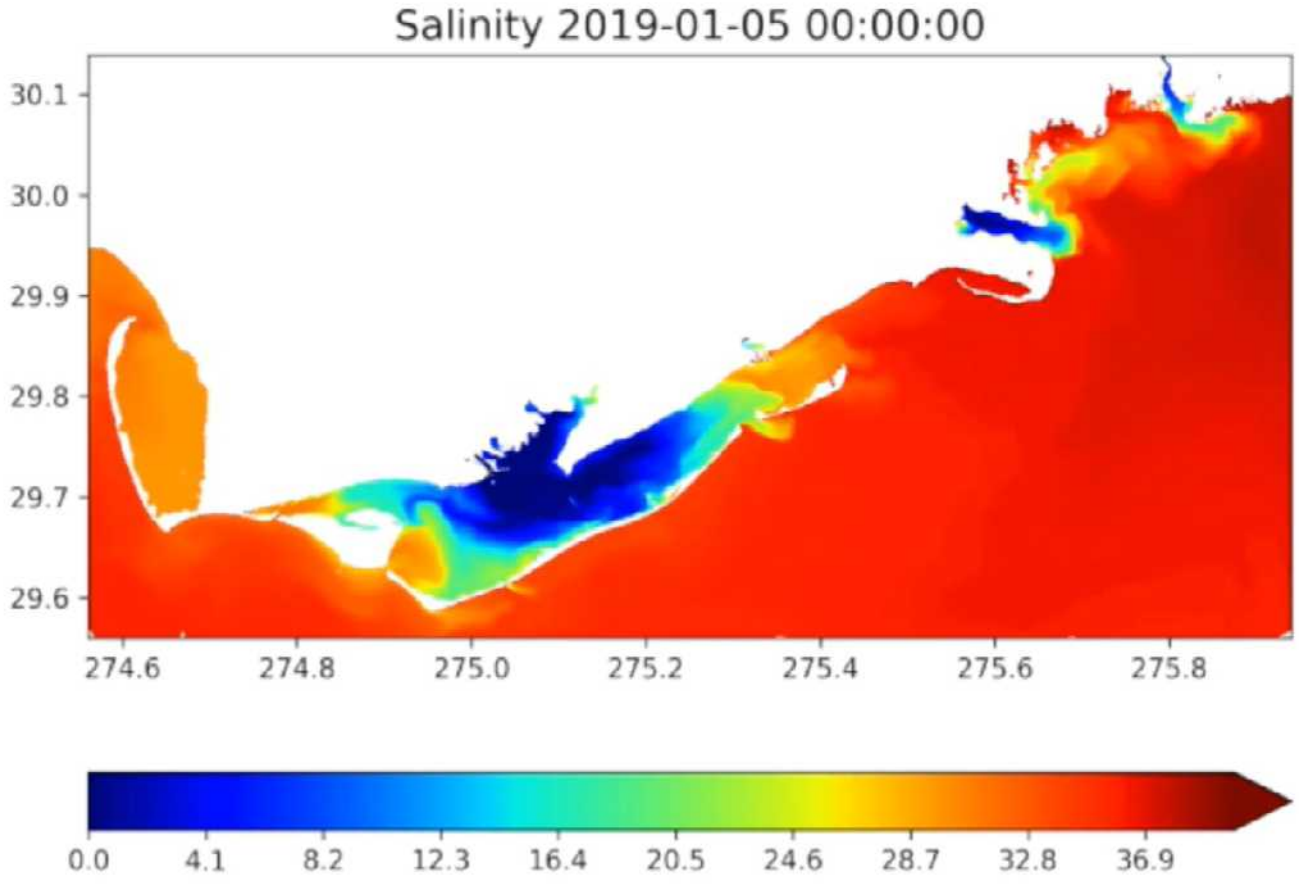
Forcing at boundary:
Currents
Temperature
Salinity
Water elevation (tides)
From Gulf of Mexico hydrodynamic model

Atmospheric forcing:
From weather model or
Downscaled from climate model

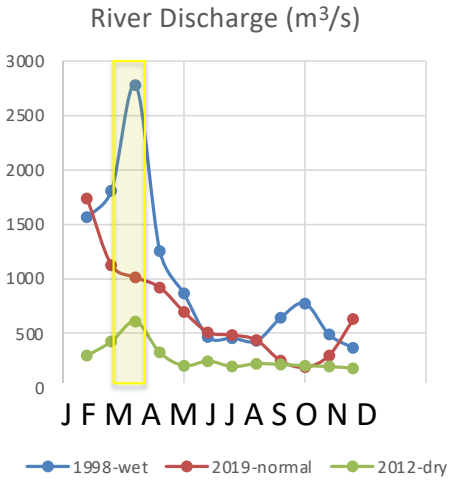
ABSI Hydrodynamic Model Configuration

- **Finite Volume Coastal Ocean Model (FVCOM)**
- **Mesh Resolution**: 800m - 30m (water and land)
- **Vertical Grid:** 10 layers
- **Surface Forcing**: CFSR (atmospheric model) and Wind Observations
- **River Discharge**: USGS or Leitman's Model
- **River Temperature:** NOAA NOS station
- **Initial Condition (U, V, T, S)**: HYCOM Reanalysis
- **Boundary Condition (Tide, T, S)**: HYCOM Reanalysis
- **Model Periods run to date**: 1998, 2011-2012, 2019

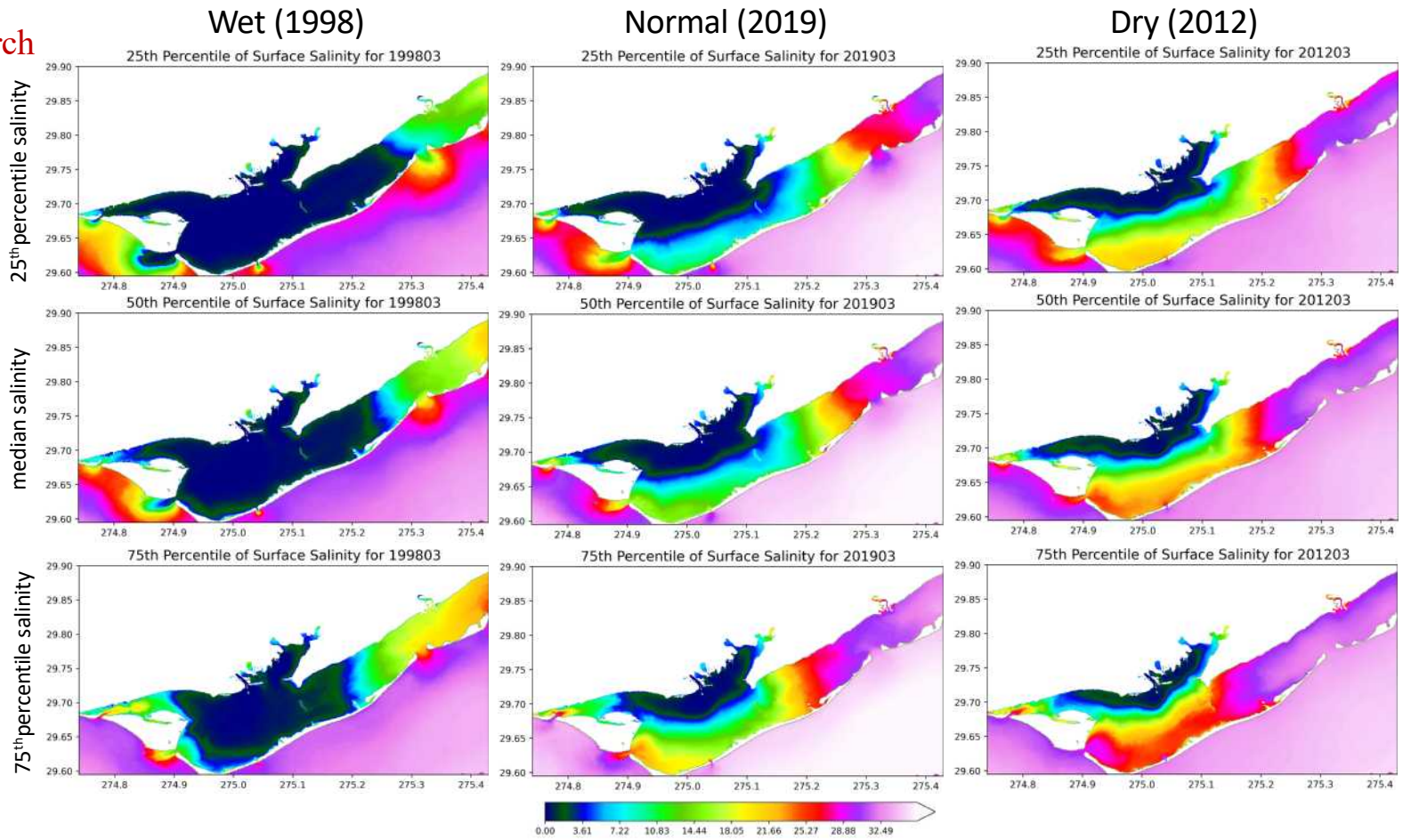



Salinity 2019-01-05 00:00:00
30.1
30.0
29.9
29.8
29.7
29.6
274.6
274.8
275.0
275.2
275.4
275.6
275.8
0.0
4.1
8.2
12.3
16.4
20.5
24.6
28.7
32.8
36.9

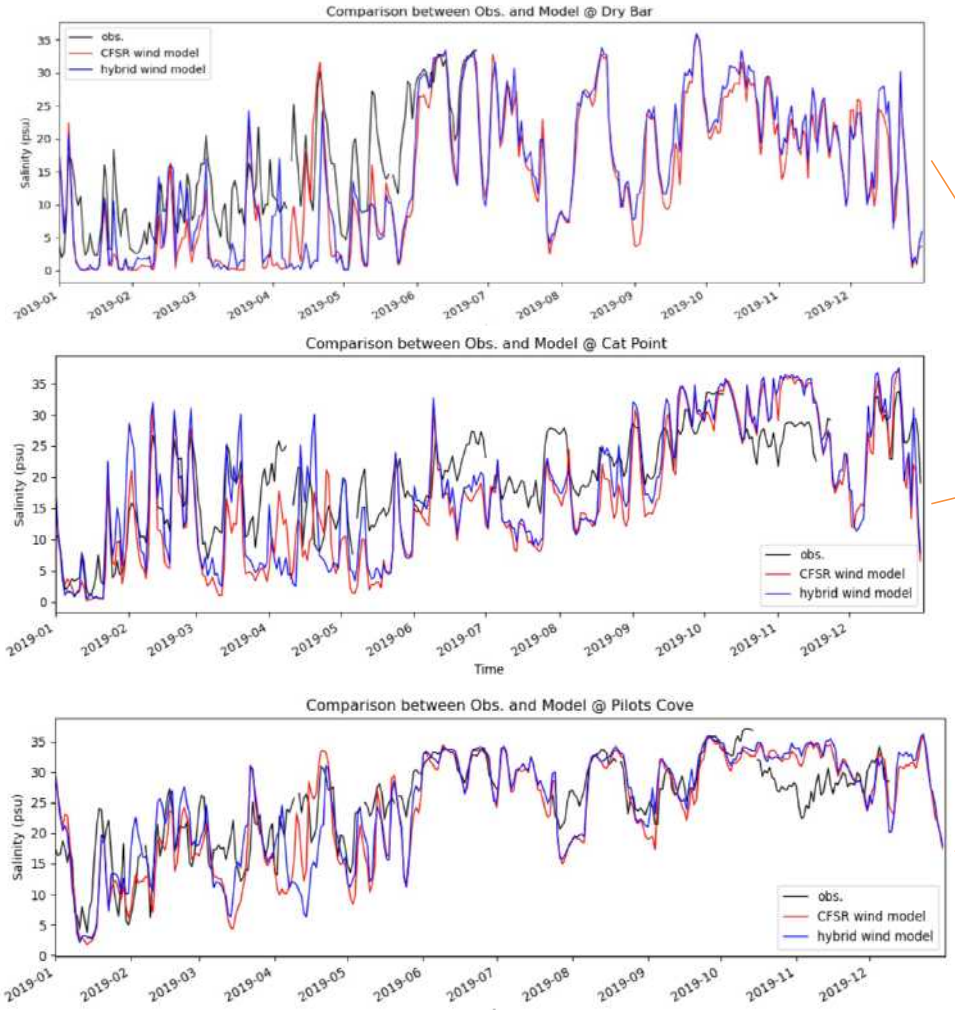
Maps of salinity quantiles (median, 25th percentile, 75th percentile) corresponding to wet, normal, and dry March.



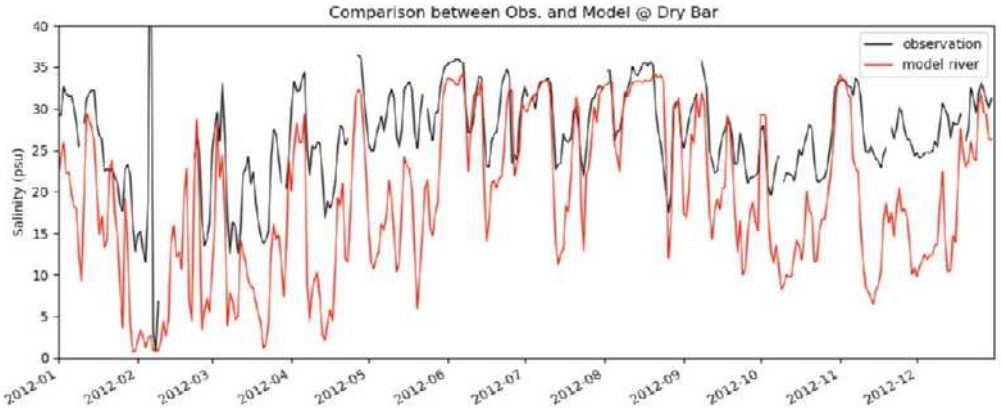
March



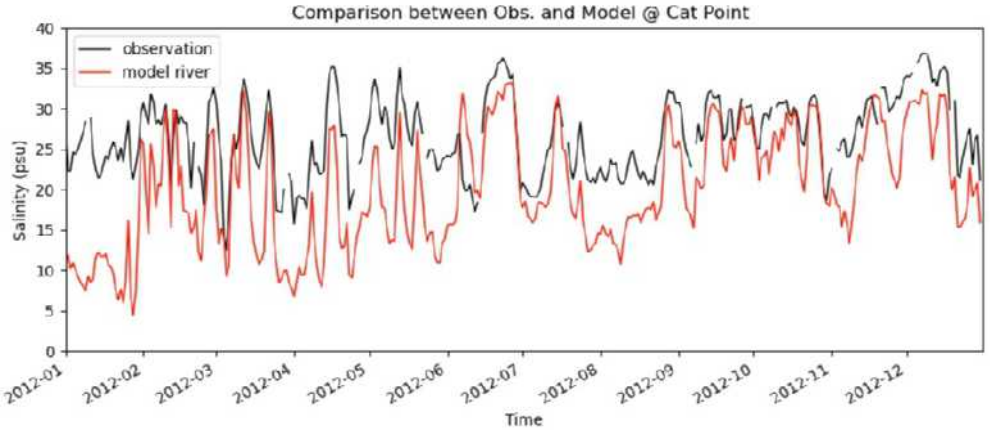
Model vs. Observation (Salinity 2019)



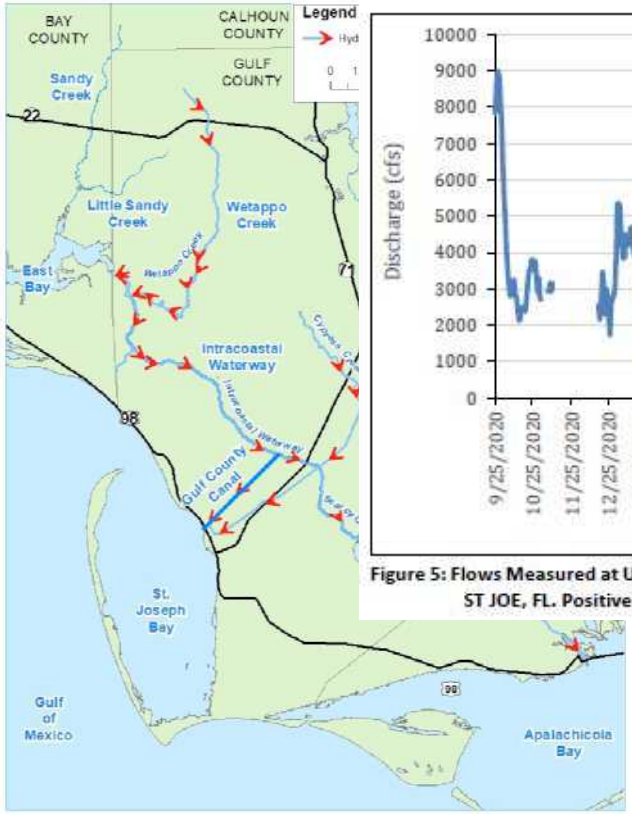
Model vs. Observation (Salinity 2012)



A low salinity bias was discovered in the 2012 (dry year) simulation



Apalachicola River Diversion through the Intracoastal Waterway



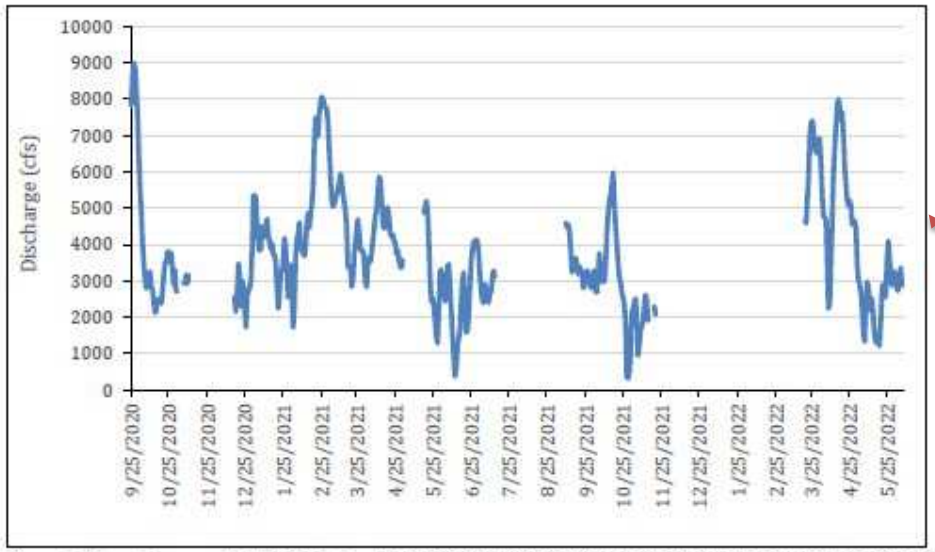
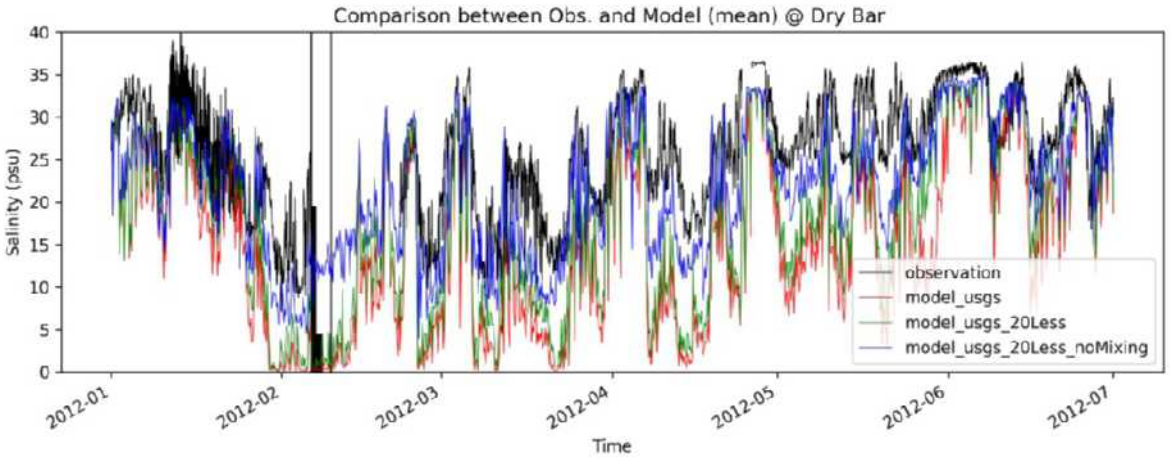


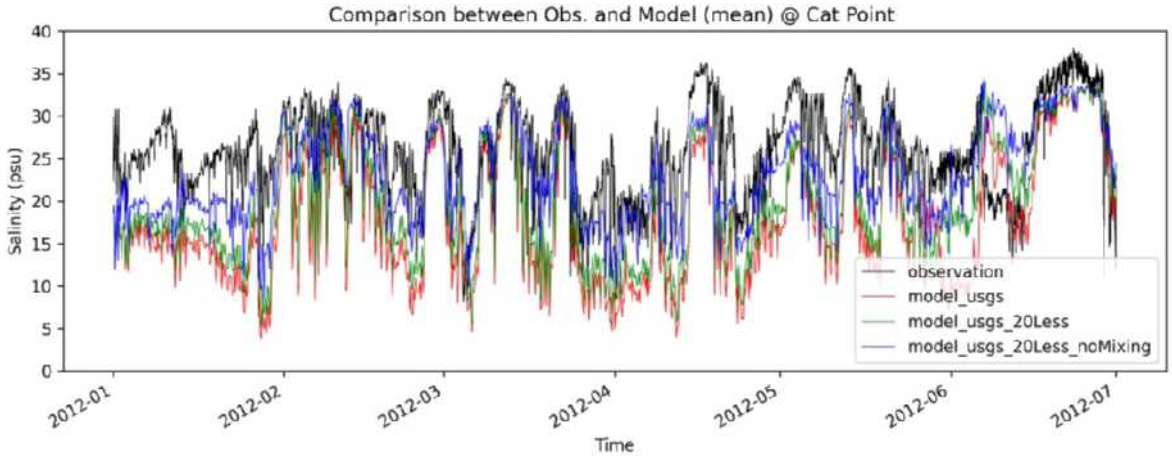
Figure 5: Flows Measured at USGS Station 0298308085143700 (IWW EAST OF GULF CO CANAL NEAR PORT ST JOE, FL. Positive flows indicate flows towards the Gulf County Canal and St. Andrew Bay.

Flow directions from Nat'l Hydrography Dataset V2

Locations of Monitoring Stations

Model vs. Observation (Salinity 2012)



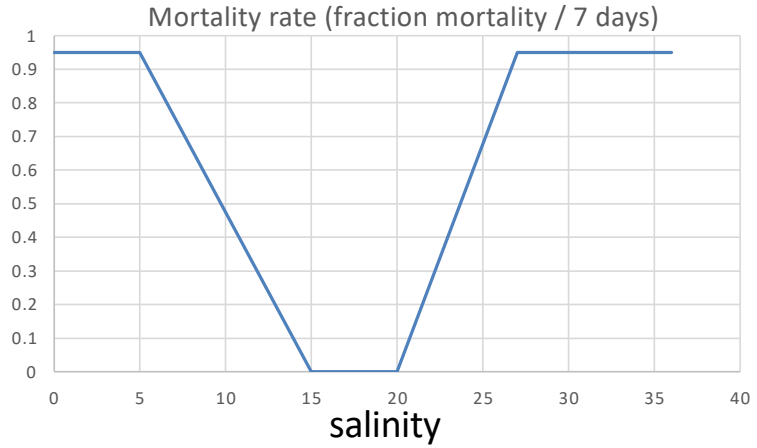


Oyster Larvae Model

Individual-Based Larval Model (FVCOM I-State Configuration Model – FISCM)

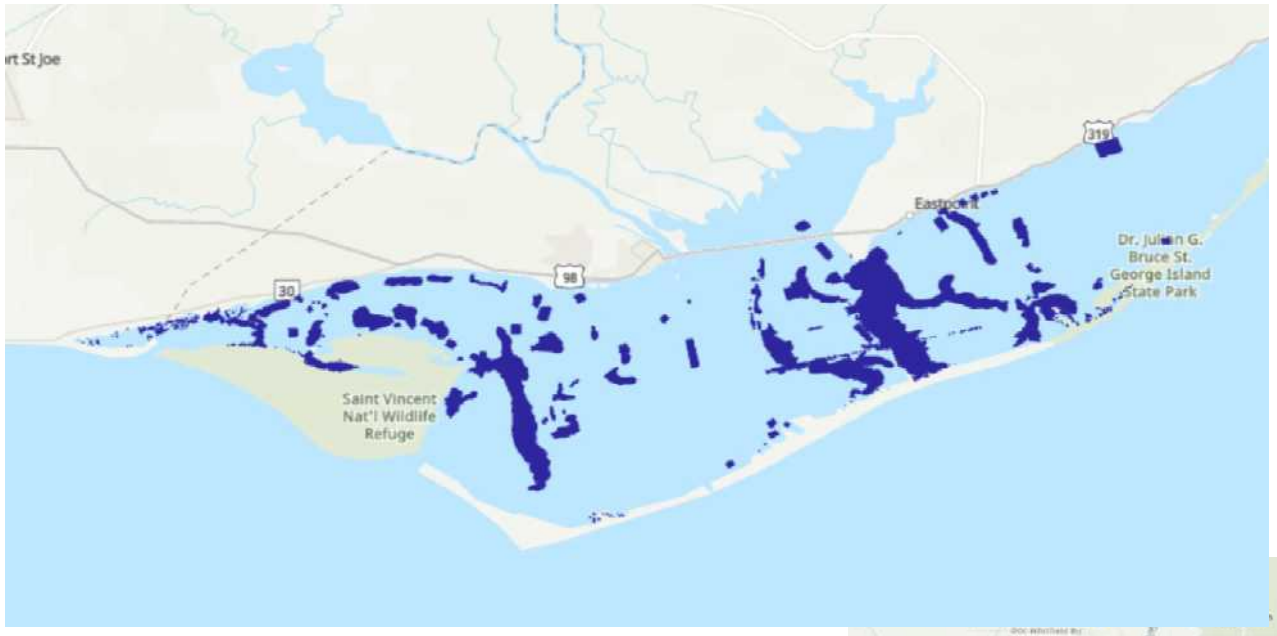
- Larvae simulated as Lagrangian particles, each representing a group of larvae that travel together
- Larvae released from submerged and intertidal reef locations every 6 hours
- Larvae advected passively in 3-dimensional velocity field for 20 days.
- Larval mortality: The fraction of living larvae represented by each group is calculated during advection based on a mortality rate ranging from 0 in a suitable environment to 0.95/7 days (95% die in one week) for unsuitable environment

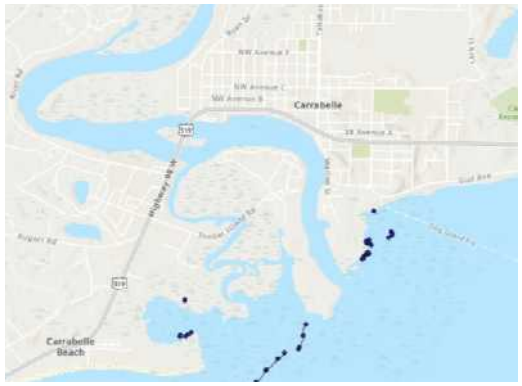
A larval group is considered "dead" of P<.05.



- Larval settlement: Larval particles that pass over reef locations during the last 5 days of their simulation time are considered as successfully settled.

Oyster Larvae Release Locations

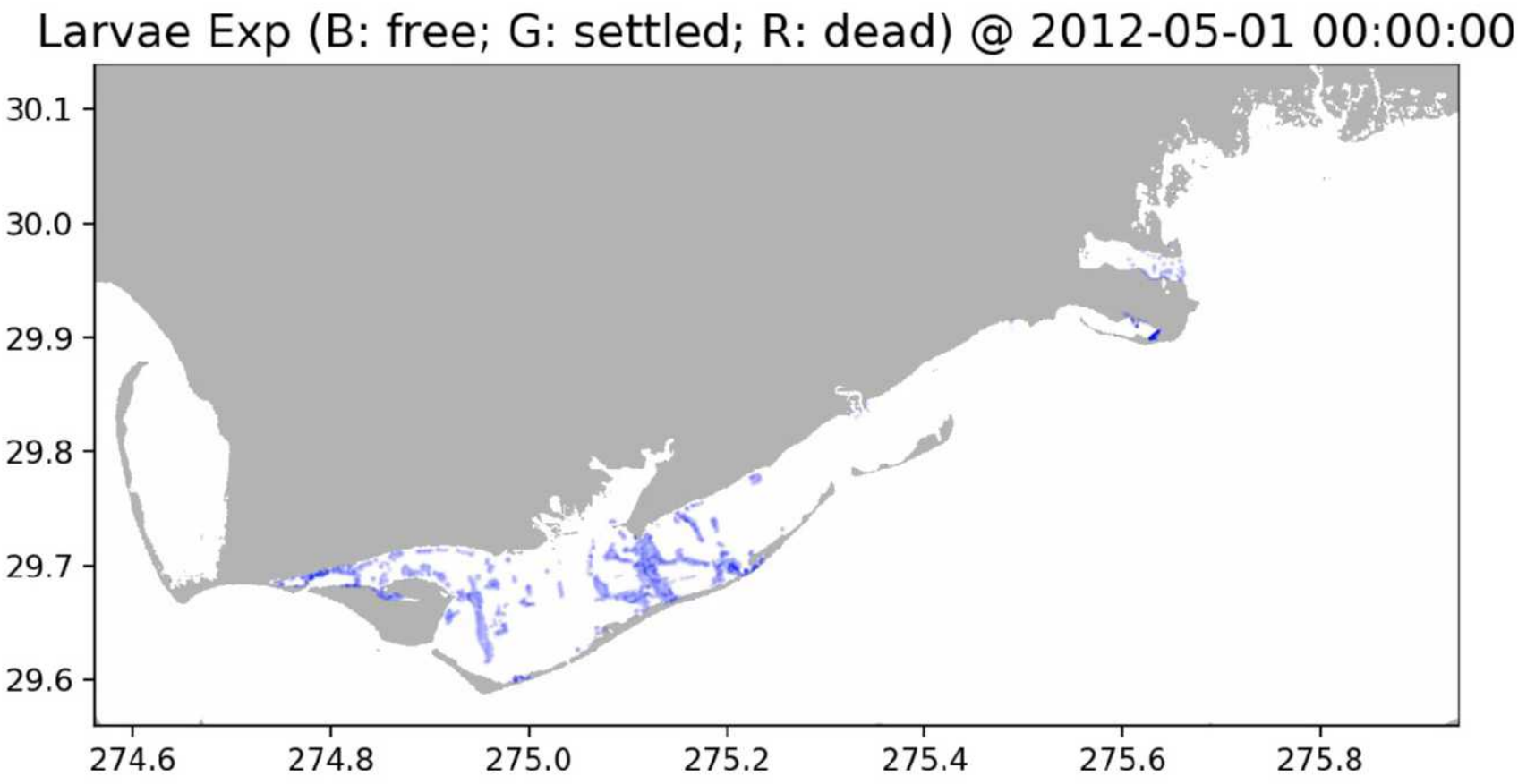




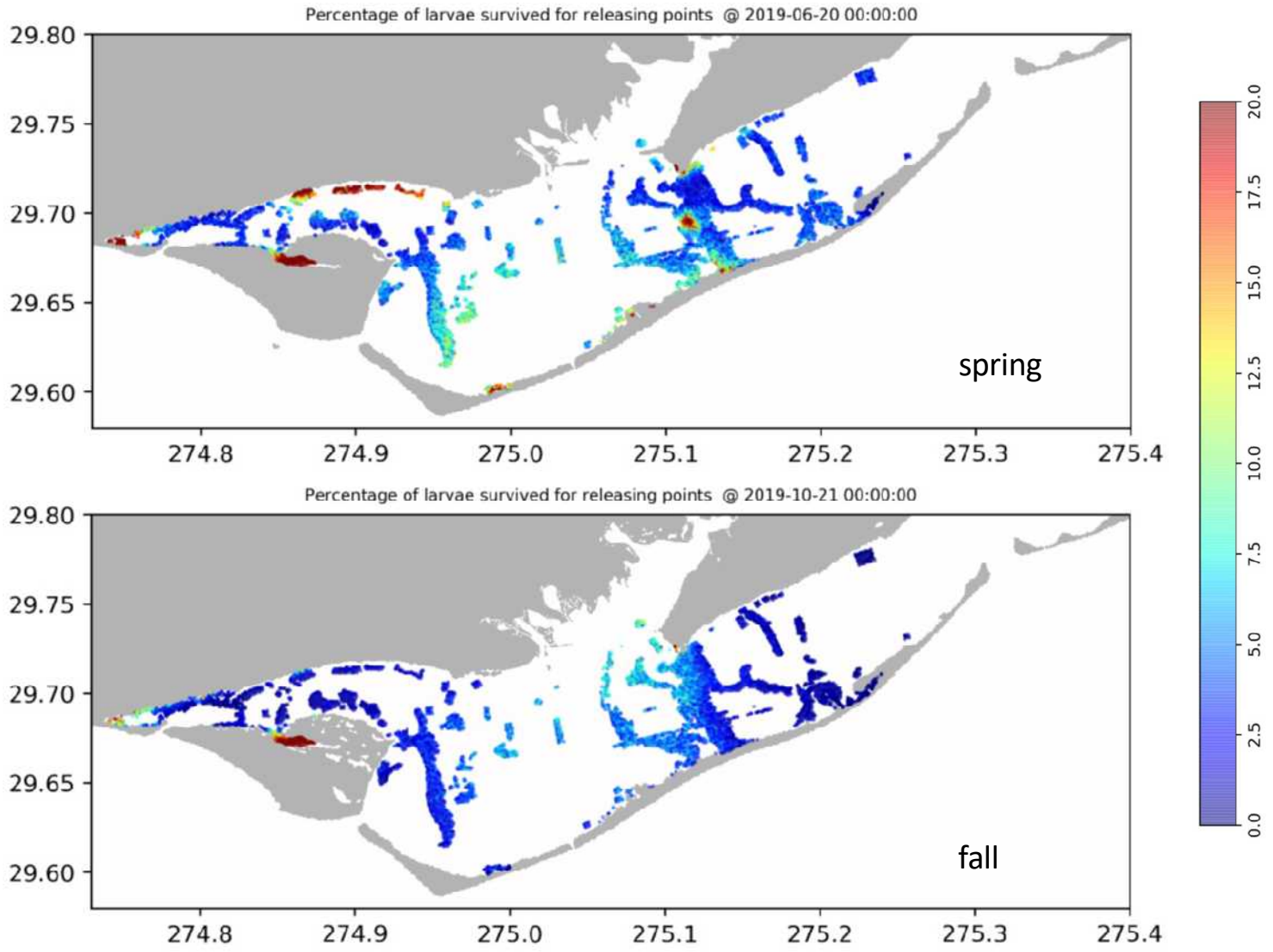
Oyster Larvae Release Locations

- 10504 locations
- Released every 6 hours

Blue – live larval groups still drifting; Green – settled larval groups; Red – Dead larval groups

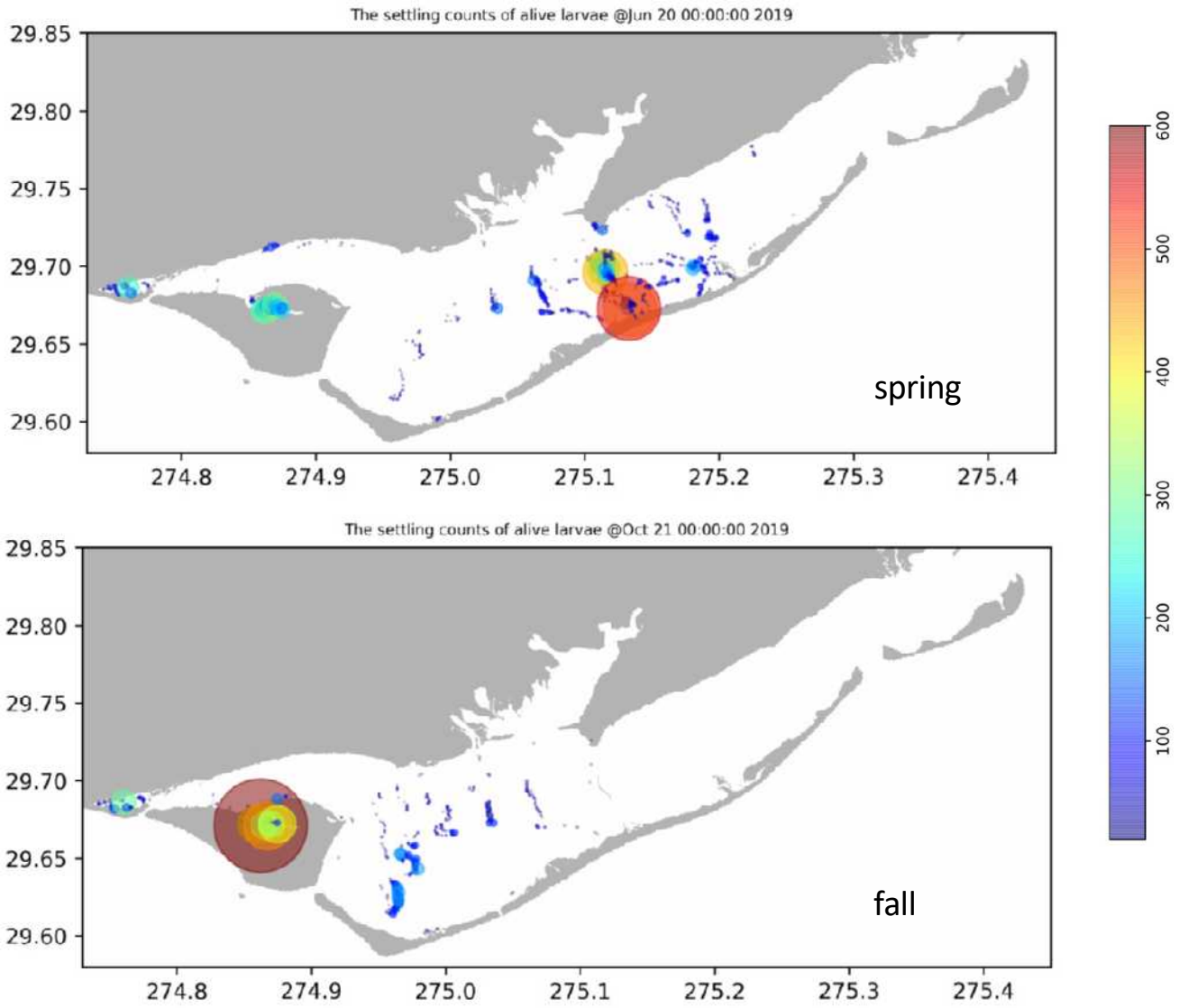


Percent of larvae that survive from each spawn location



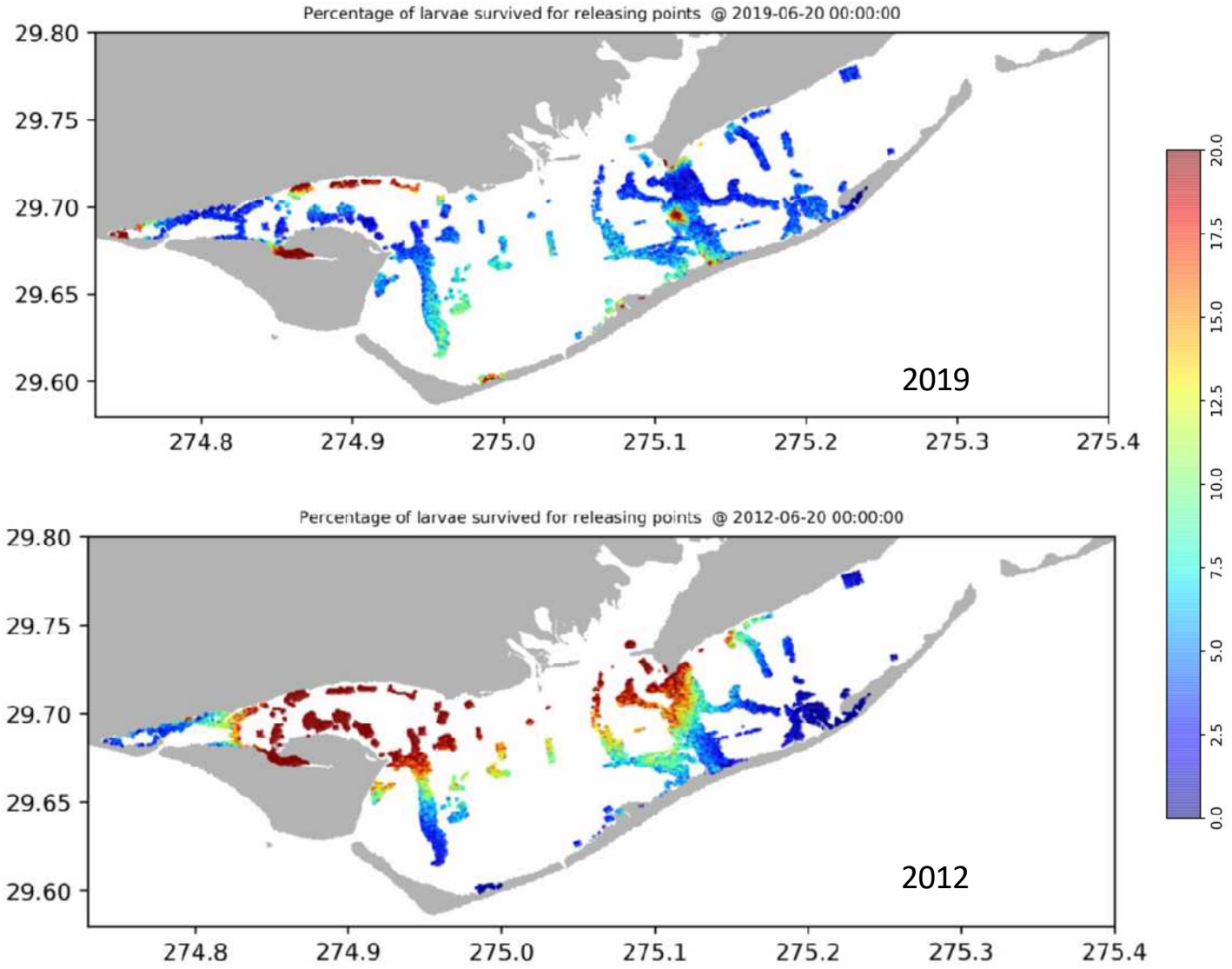
Larvae settlement

Shift in larval settlement patterns to the west during fall season



Comparison of
2019 (normal flow)
To
2012 (low flow)

- 2012 was a low recruitment year but the model is showing elevated recruitment.
- Need input from biologists to better parameterize larval mortality.



Summary

- A coupled modeling system was developed to simulate
  - Apalachicola Bay circulation and hydrography
  - Response of Apalachicola Bay to altered river flow scenarios
  - Oyster larvae transport, settlement, and survival likelihood

- Results of model experiments highlight that additional factors contribute to high salinity conditions during low flow conditions of the Apalachicola River

- Increased larval recruitment during spring season compared to fall season

- Results point to hot spots for larval supply and larval settlement.

- The modeling system will benefit from additional biological information.

- Model results are being used collaboratively by partners, e.g., Habitat Suitability Models