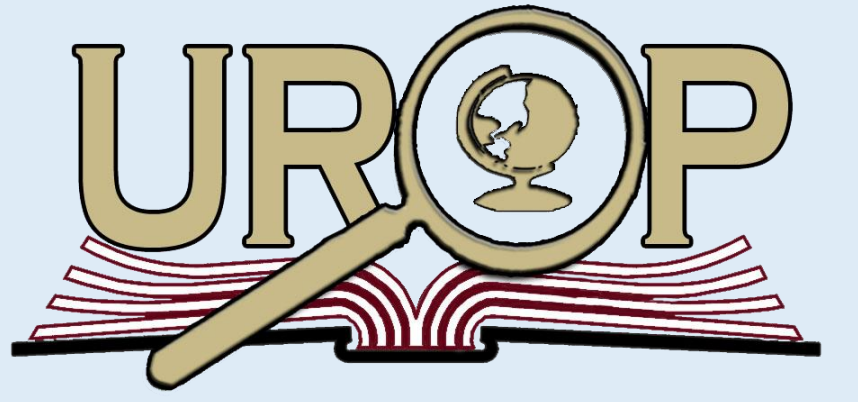# 3-D Model Analysis of Artificial Oyster Reefs in Apalachicola Bay

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BACKGROUND INFORMATION

- Apalachicola Bay is located on the northeast coastal area of the Gulf of Mexico in Florida and is a historical major oyster fishery (Fig. 1)
- Due to anthropogenic and environmental stressors in 2013, the ecosystem collapsed and was declared an environmental disaster causing FWC to place a moratorium on commercial harvesting of oysters in 2020 (Brooke, 2022)
- The Apalachicola Bay System Initiative (ABSI) seeks to gain insight into the root causes of decline of the bay's ecosystem and the deterioration of oyster reefs striving to develop a management and restoration plan for the oyster reefs and health of the bay
- Following the collapse, the region experienced a switch from supporting highly productive benthic fisheries species to more pelagic water species (Brooke, 2022)

INTRODUCTION

- This project utilizes artificial reef structures called reef balls (Fig. 2) to understand how environmental characteristics influence habitat use and recovery of associated oyster reef communities
- This project aims to identify sites in the bay with the most potential for future shelling and restoration efforts
- Agisoft Metashape, a photogrammetry software, is used to calculate volume of reef balls to analyze the current rate of benthic productivity throughout the bay
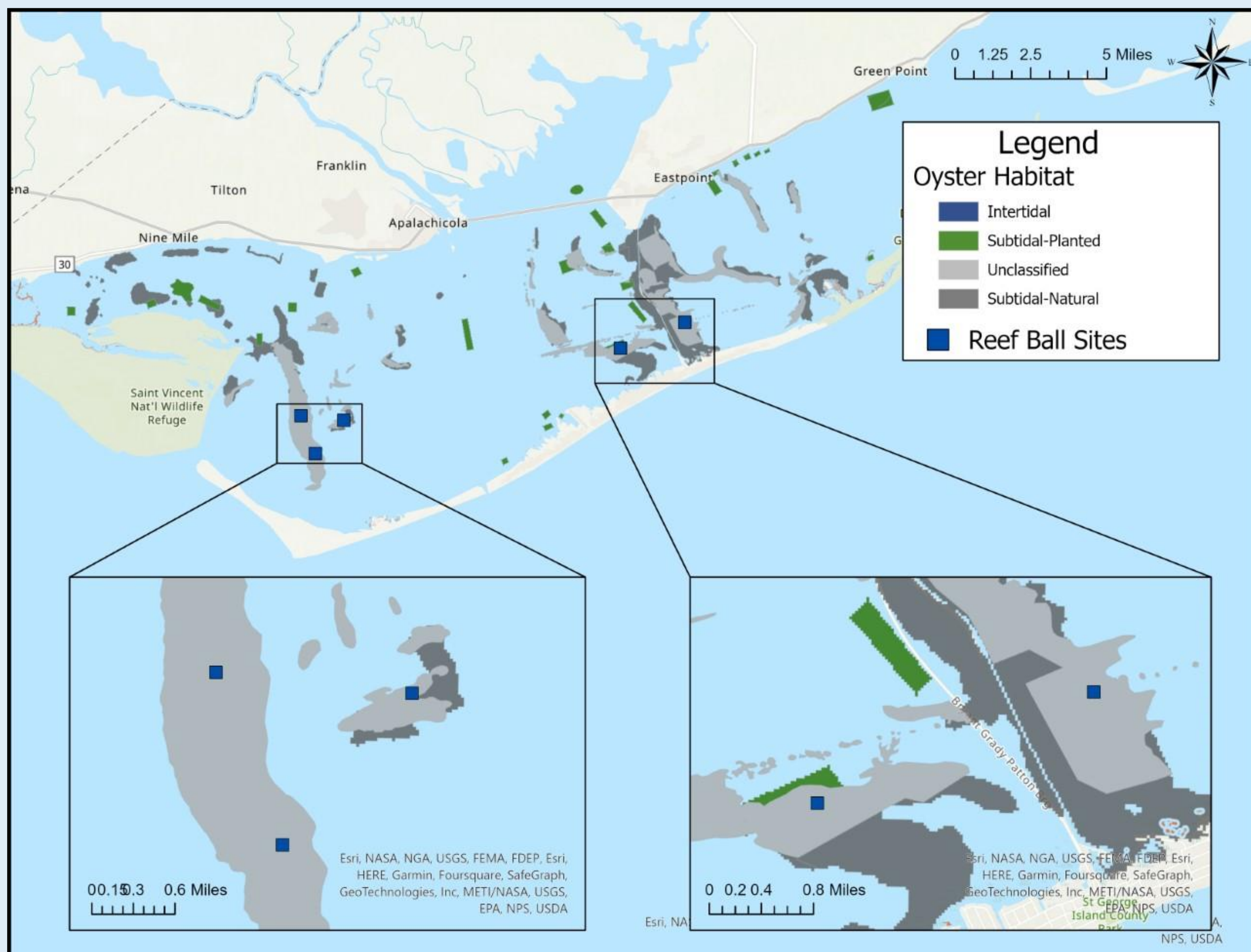

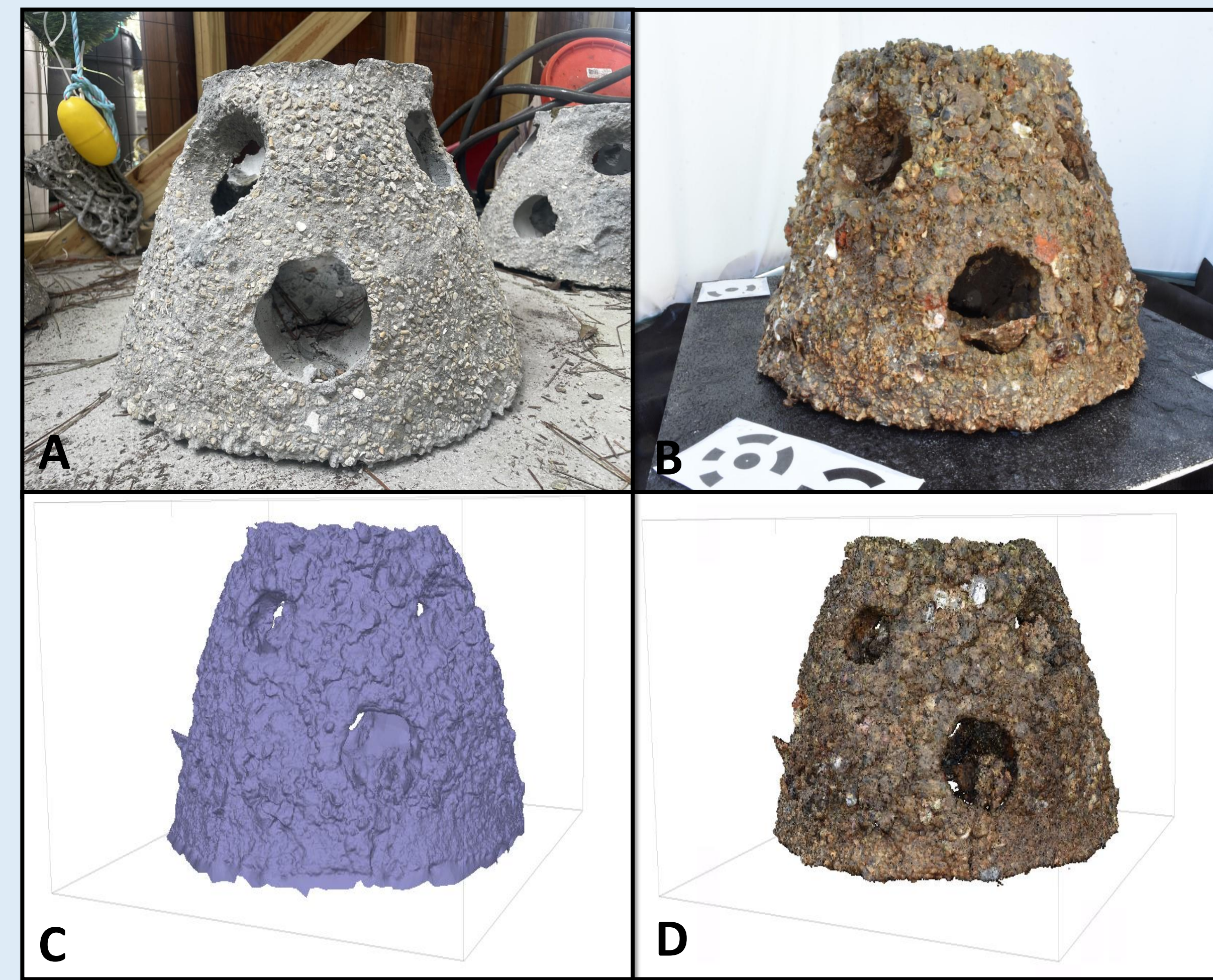Figure 1: A map of Apalachicola Bay and the locations of artificial reefs

Figure 2: Reef Ball photogrammetric development
A: Photo of Reef Ball Pre-deployment
B: Photo of Reef Ball six months after deployment
C: Solid 3D model of a reef ball
D: Textured 3D model of a reef ball

METHODS

- Reef balls, made of concrete and calcium carbonate were produced to mimic oyster reef structures
- The structures were placed in various regions throughout Apalachicola Bay to capture a variety of environmental conditions (Fig. 1)
- Benthic temperature, percent dissolved oxygen, concentration of dissolved oxygen, conductivity, salinity, pH, and turbidity are recorded at each of the deployment sites
- At each of the deployments, HOBO loggers are used to measure temperature and conductivity and MiniDOT loggers measure dissolved oxygen on each side of the bay
- Every sixth months, the structures are retrieved, photographed, and pictures are uploaded to Agisoft Metashape to create 3D models and calculate volume of each individual reef ball
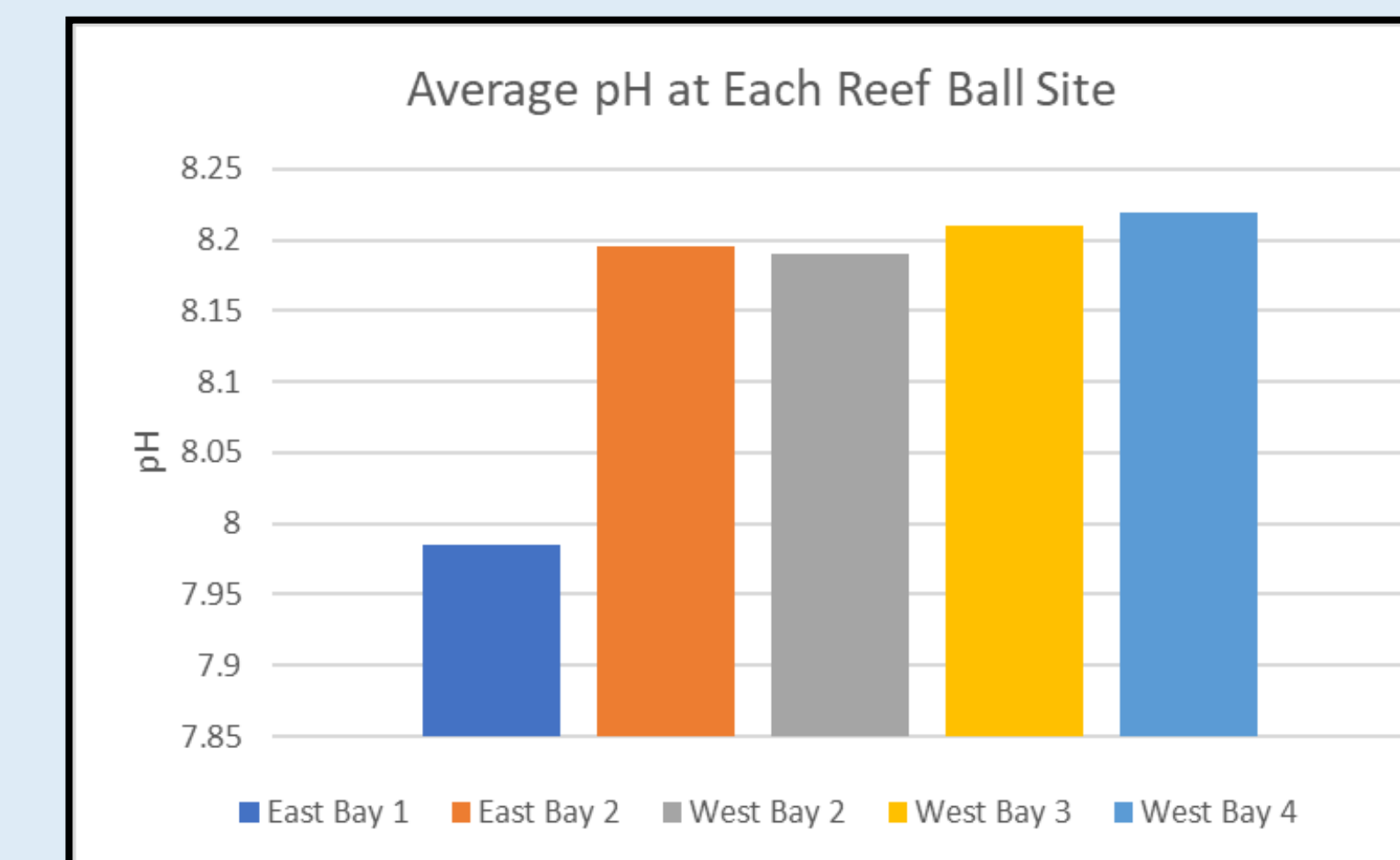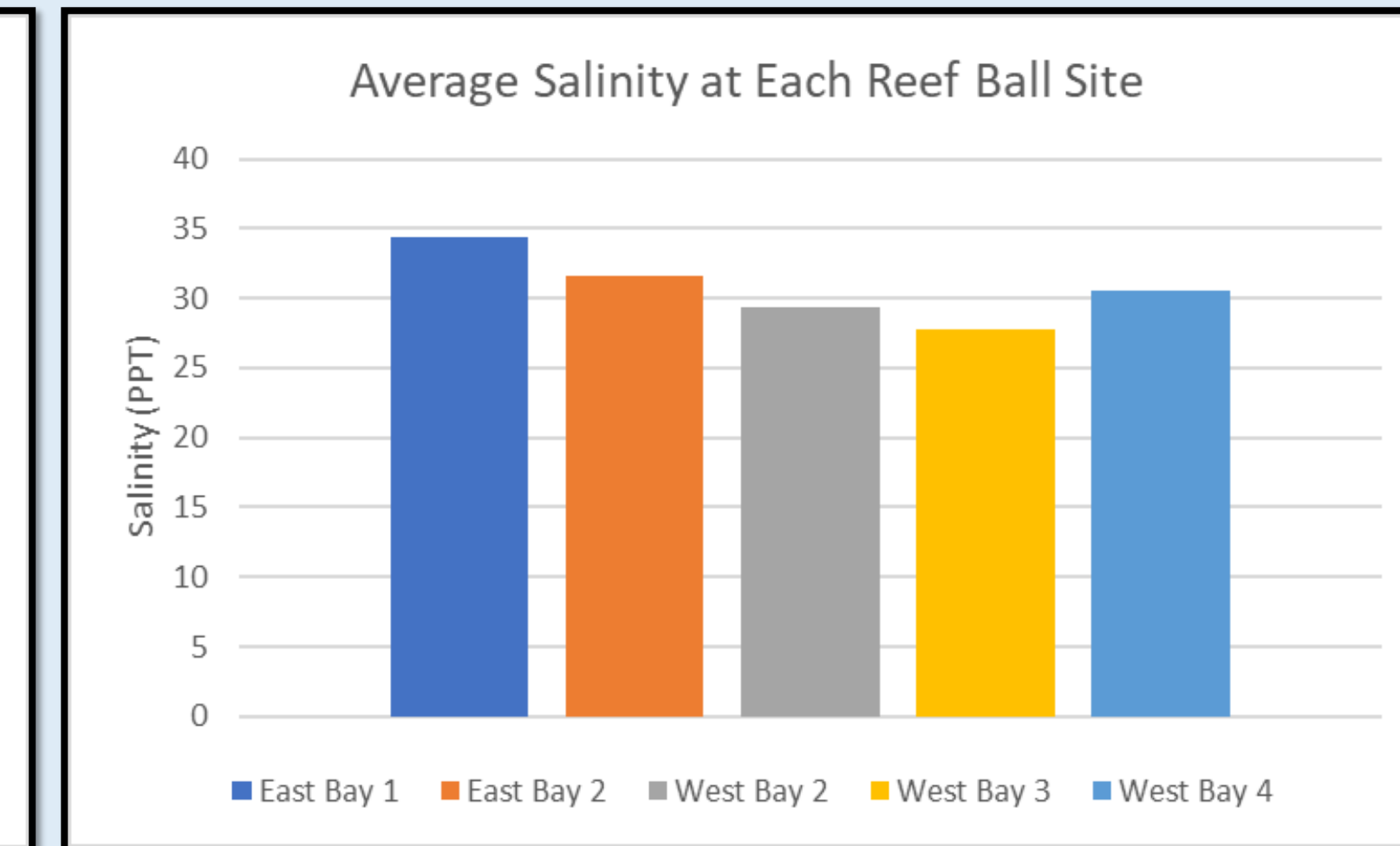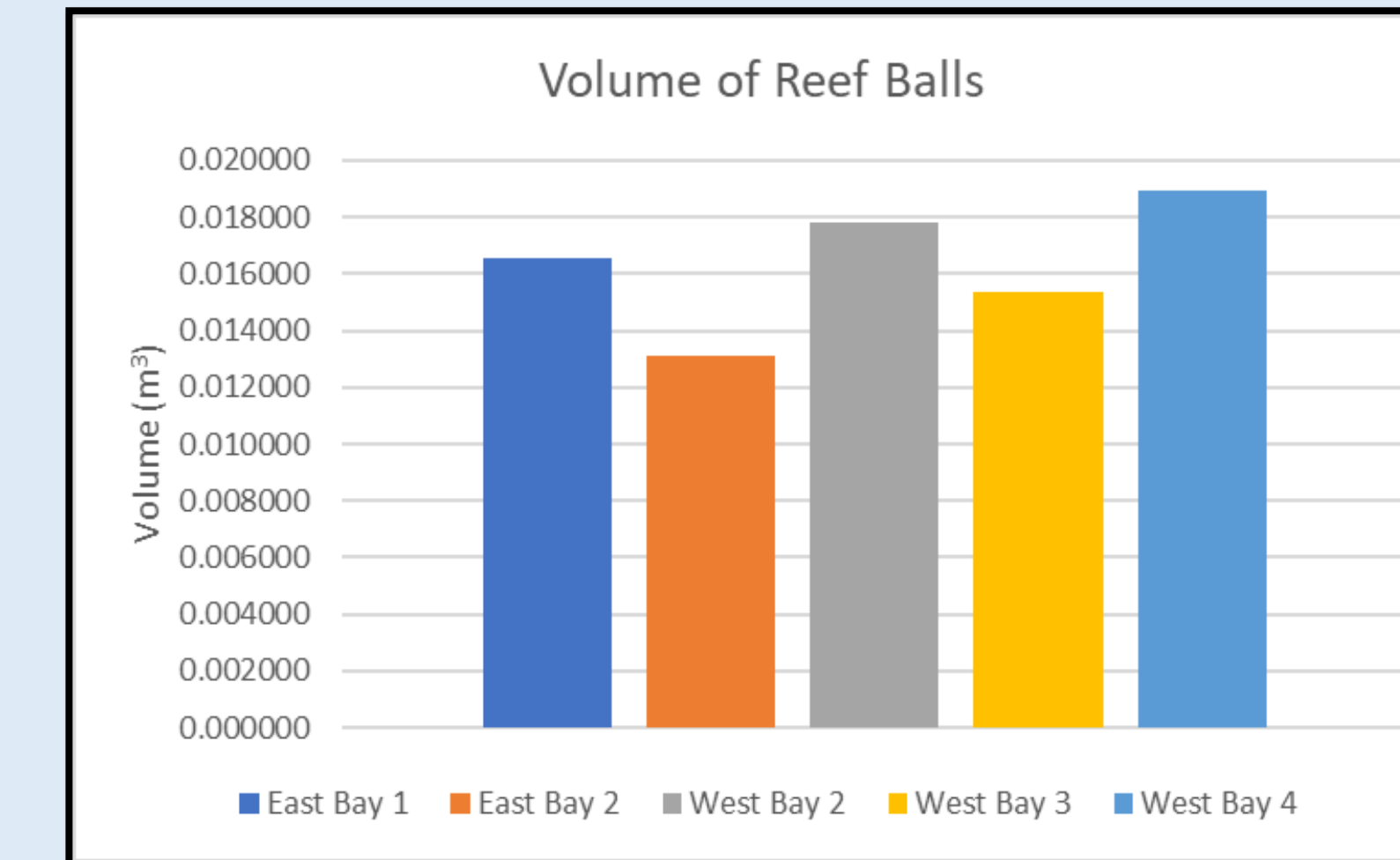- Volumes are compared to detect settlement differences across the bay

RESULTS

Figure 3: A graph of the volume of 5 different 3D modeled reefs balls

Figure 4: A graph of the average salinity recorded at 5 deployment sites by YSI meters

Figure 5: A graph of the average pH values recorded at 5 deployment sites by YSI meters

Figure 6: ABSI Technicians and divers deploying artificial reefs within the bay.

CONCLUSION/FUTURE WORK

- Preliminary results depicted that the volume of west bay reefs balls was greater than the volume of east bay reef balls (Fig. 3)
- Volume differences of reef structures may result from differences in water quality throughout the bay, but it is too early in the project to make significant conclusions (Figs. 4 & 5)
- Reef balls will be pulled up 3 more times for further analysis and the completion of the 2-year project in April of 2024

REFERENCES

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