

# CHARACTERIZING DEOXYGENATION AND HARMFUL ALGAL BLOOMS IN BRANCHPORT CREEK, NEW JERSEY

Skyler Post<sup>1</sup>, Erin Conlon<sup>1</sup>, Kelly Hanna<sup>1</sup>, Victoria Lohnes<sup>2</sup>, Maria Riley<sup>1</sup>, Ariel Zavala<sup>3</sup>, and Jason E. Adolf<sup>1</sup>

<sup>1</sup>Monmouth University Department of Biology; <sup>2</sup>Monmouth University Department of History and Anthropology; <sup>3</sup>Monmouth University Department of Chemistry

## Introduction

Deoxygenation of coastal waters due to the presence of harmful algal blooms (HABs) is not only a local crisis but has been expanding globally. HABs occur more frequently when phytoplankton, an important marine primary producer, are exposed to high temperatures and high nutrients for an extended amount of time. As HABs become pervasive in coastal environments, hypoxic and anoxic water conditions increase, and both HABs and anoxic conditions are capable of causing fish kills. Branchport Creek in the Shrewsbury River is known to be polluted and experiences frequent deoxygenation and fish kills. However, the phytoplankton and HABs in these waters have not been characterized. Our objective was to characterize the phytoplankton growing here to determine their role in the deoxygenation and fish kills observed in Branchport Creek.

## Methodology

- Stations in Sandy Hook Bay, the Navesink River, and the Shrewsbury River including specific sites within Branchport Creek were sampled.
- In Situ measurements taken include chemical and biological parameters (salinity, temperature, oxygen, pH, turbidity, chlorophyll, and light transparency in the water column)
- Samples from each station were preserved in glutaraldehyde
- Chlorophyll *a* was extracted in vitro via acetone
- Preserved samples were examined under a Nikon Diaphot 300 Inverted microscope and analyzed

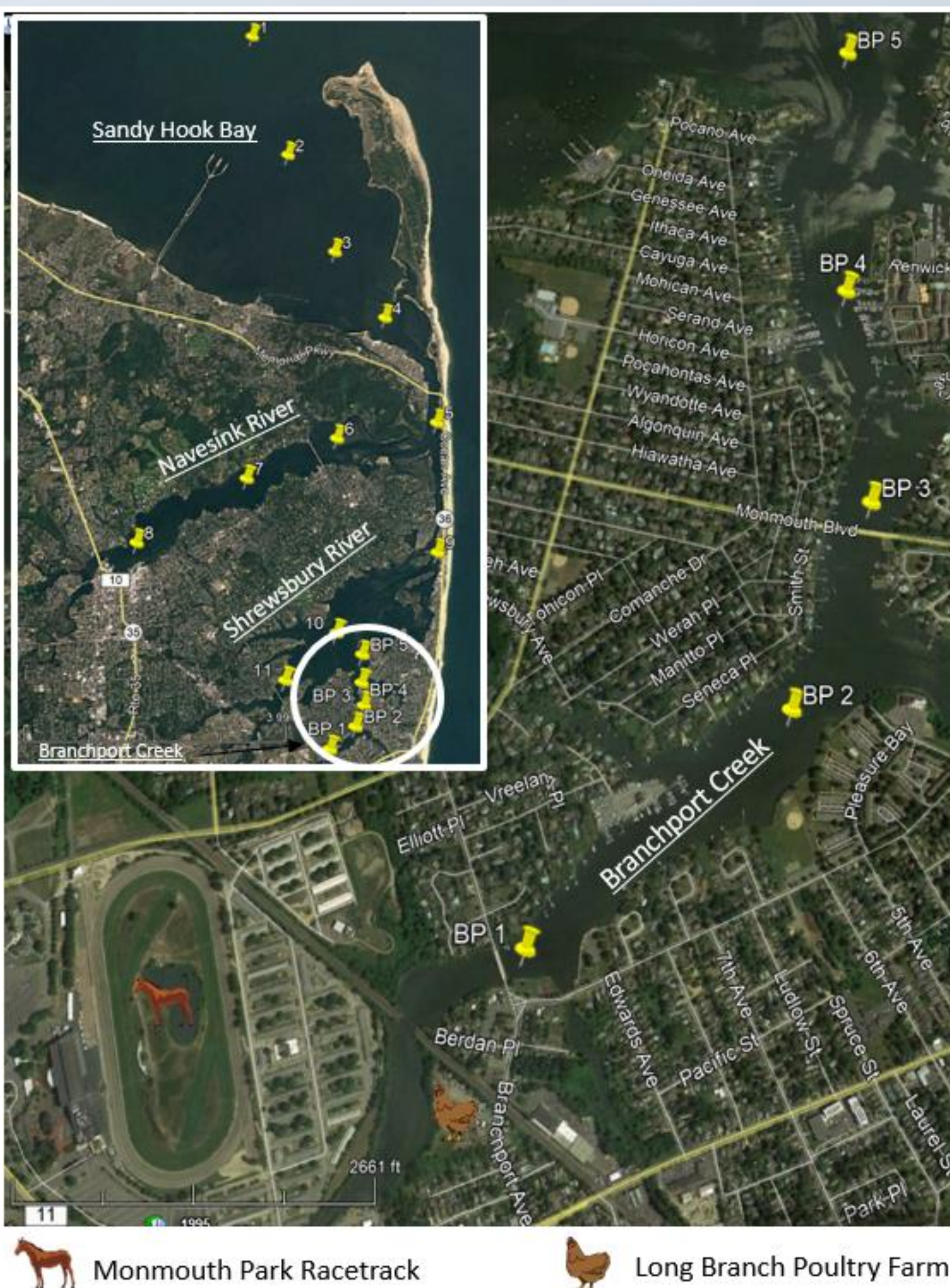


Figure 1: The inset map shows stations in Sandy Hook Bay, the Navesink River, and the Shrewsbury River. The map shows closer stations set up in Branchport Creek ranging from upstream (BP1) to downstream (BP5).

Branchport Creek is known for its polluted waters and fish kills. This study was designed to help determine if these marine mortalities were caused by HAB species, lack of oxygen, or both. This study found fish-killing HAB species and anoxia in Branchport Creek, suggesting both may contribute to fish kills seen here.

## Identified Phytoplankton

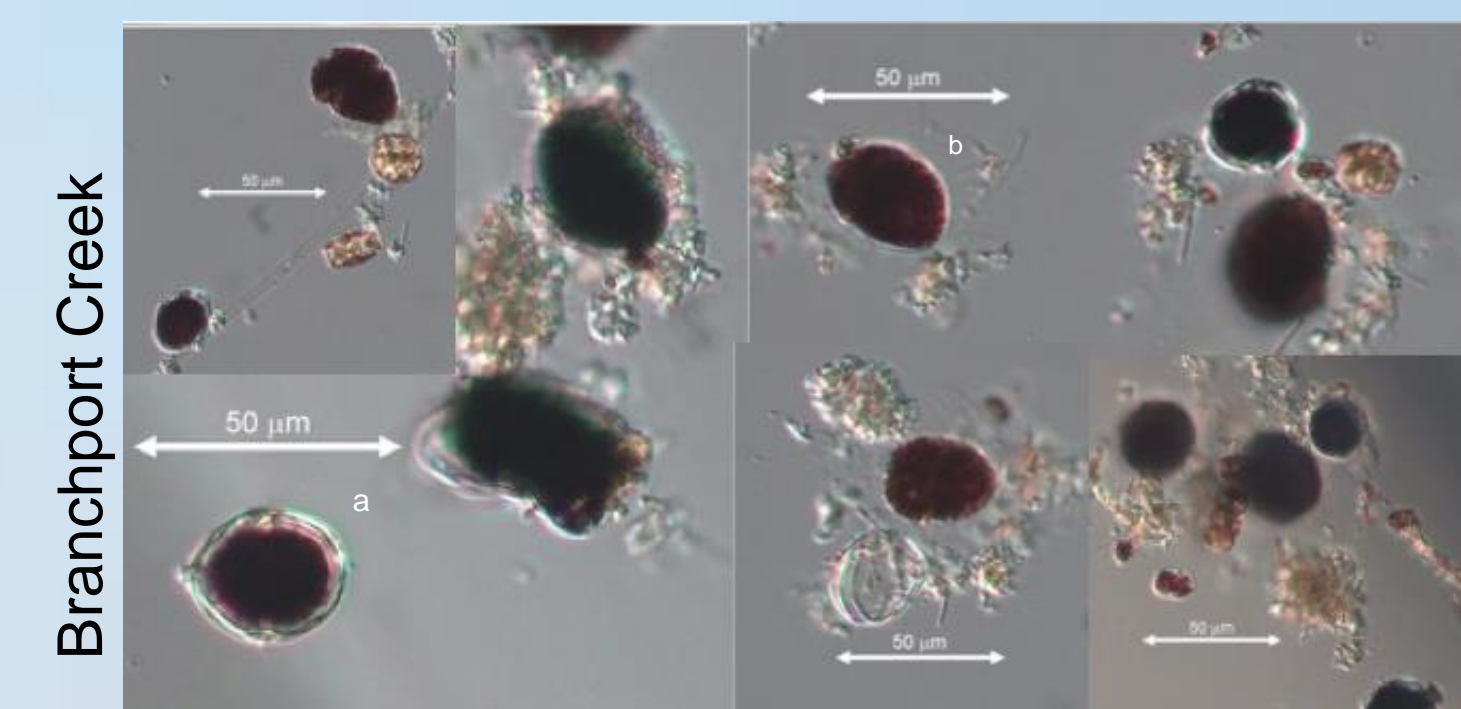


Figure 1: BP3 plankton tow 07/16/19. a: *Scripsiella* sp. (dinoflagellate). b: *Akashiwo sanguinea* (aka *Gymnodinium sanguineum*; associated with fish kills).

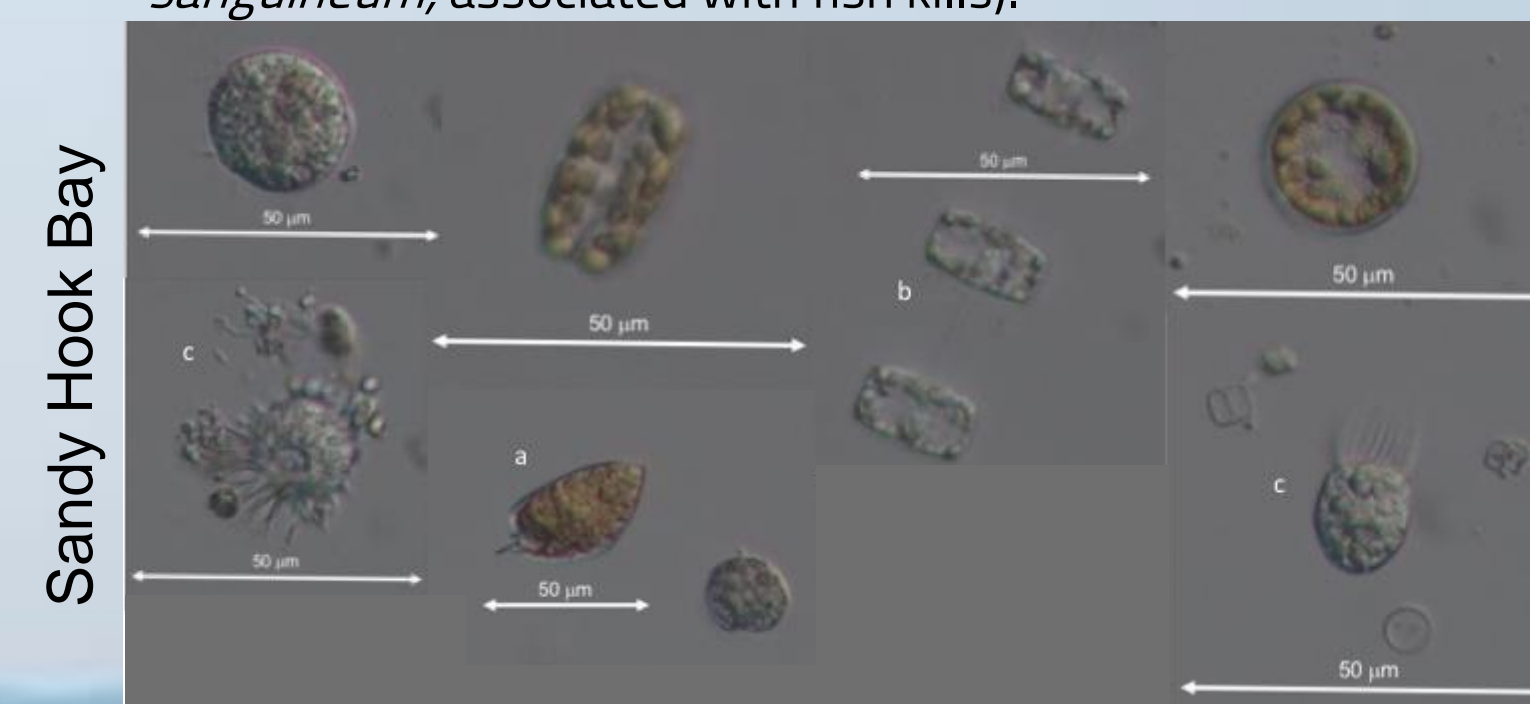


Figure 2: Station 1 plankton tow 07/16/19. a: *Prorocentrum micans* (dinoflagellate). b: *Thalassiosira* sp. (diatom). c: ciliate (microzooplankton).

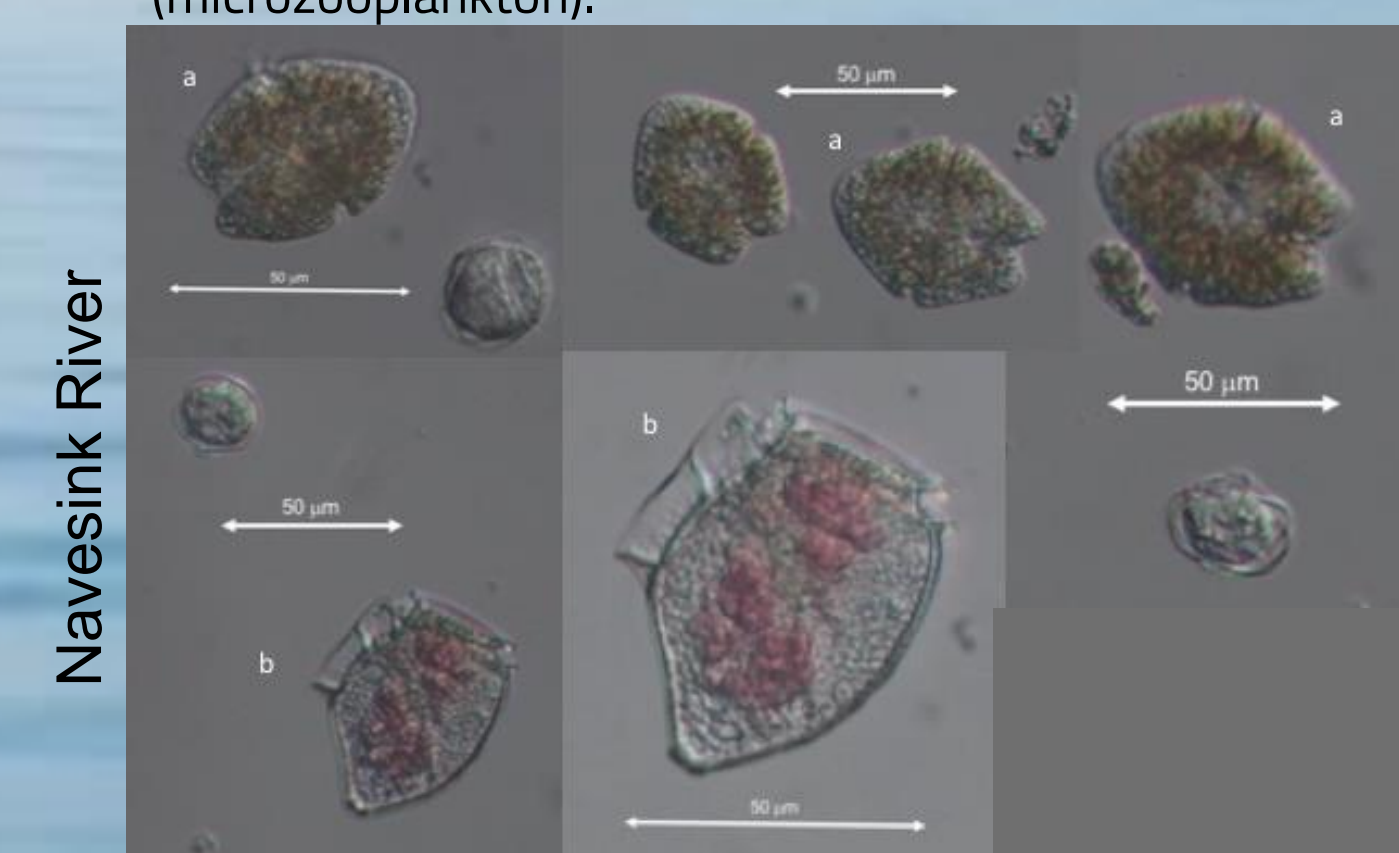


Figure 3: Station 7 plankton tow 07/16/19. a: *Akashiwo sanguinea* (aka *Gymnodinium sanguineum*) (dinoflagellate) associated with fish kills. b: *Dinophysis acuta* (dinoflagellate), produces diarrhetic shellfish toxin.

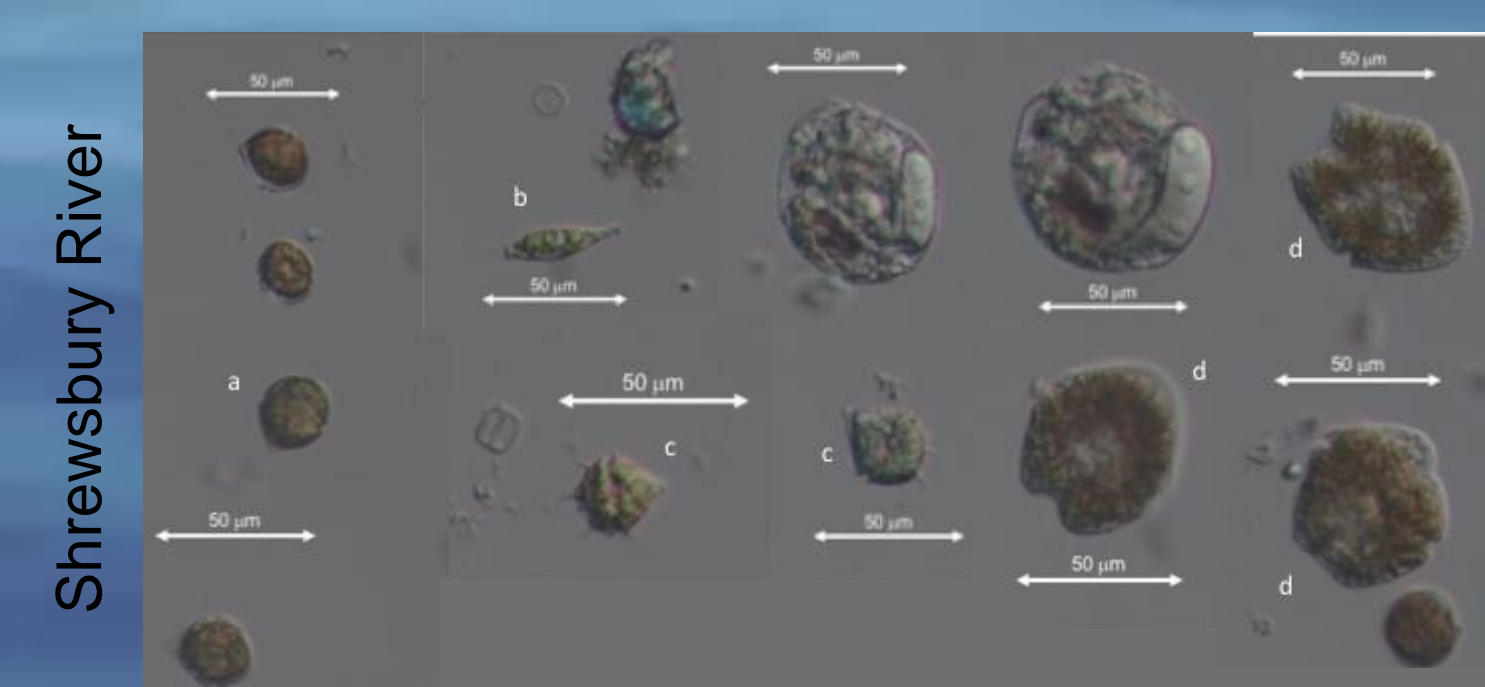


Figure 4: Station 10 plankton tow 07/16/19. a: *Scripsiella trochoidea* (dinoflagellate). b: *Euglena* sp. (chlorophyte). c: *Protoperidinium* sp. (dinoflagellate). d: *Akashiwo sanguinea* (aka *Gymnodinium sanguineum*).

## Results

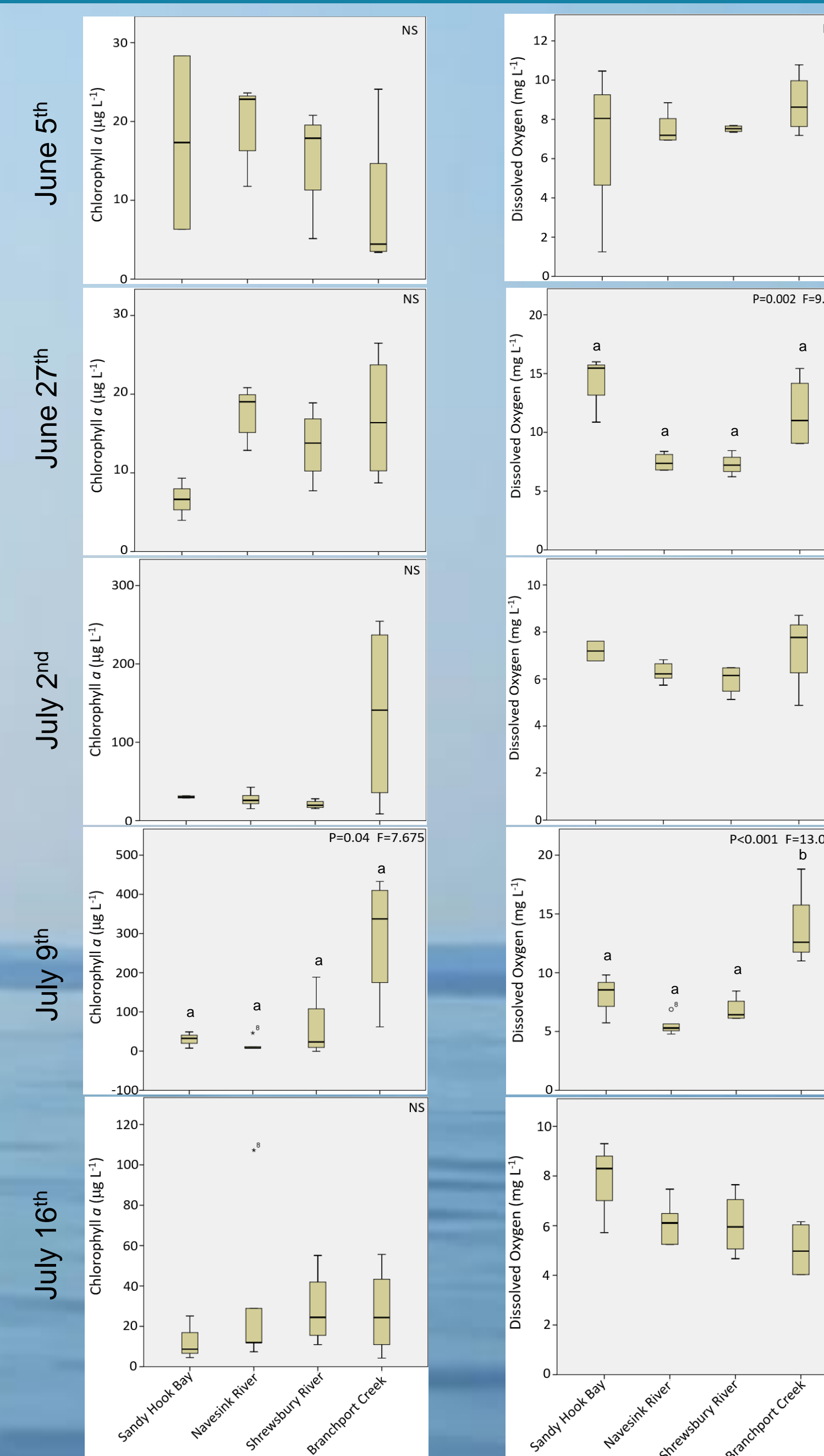


Figure 5: Box plots show the relationship of chlorophyll *a* and dissolved oxygen to each system tested from surface samples only. Though not many significant results, it can be seen that Branchport Creek's chlorophyll varies significantly more than any other system. Superscripts show systems with statistically significant values ( $p < 0.05$ ). Surface dissolved oxygen is high in all systems.

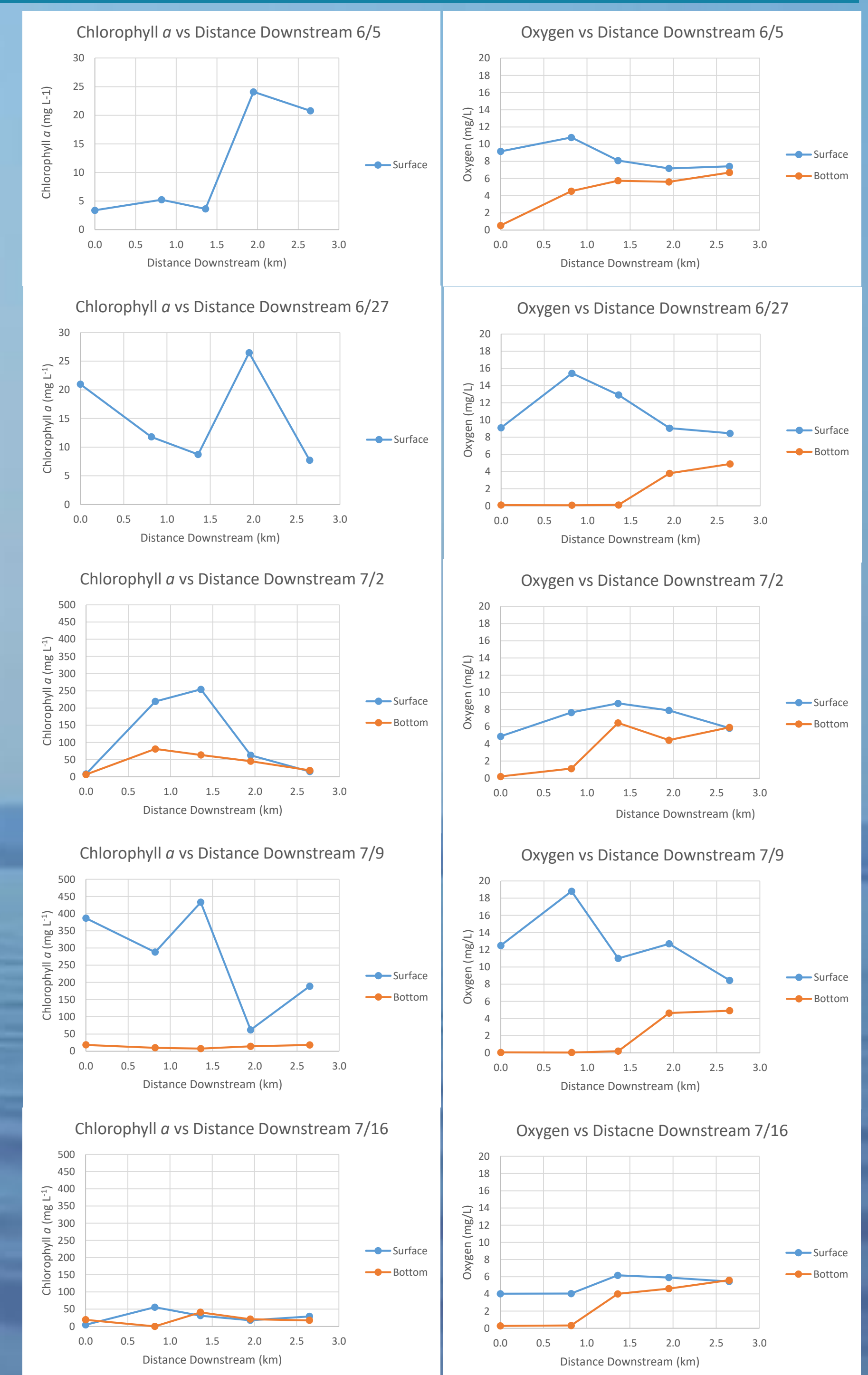


Figure 6: Constant low bottom oxygen revealed anoxic conditions (2 mg L<sup>-1</sup> or lower) upstream, and higher oxygen farther downstream. Chlorophyll *a* shows phytoplankton blooms at the surface and barely any phytoplankton at the bottom of the water column.

## Conclusion

- Drastic differences in chlorophyll *a* and oxygen in the surface water vs bottom water in Branchport Creek were found
- Fish kills were observed in Branchport Creek
- Dinoflagellates were dominant in Branchport Creek, whereas diatoms were dominant in Sandy Hook Bay
- Branchport Creek had 10-100 times higher chlorophyll *a* than any other sites
- Further research is needed to determine if the cause of these fish kills were from a harmful algal species or from the lack of oxygen in the system
- These data can provide insight to new management practices locally and globally.

## Acknowledgements

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