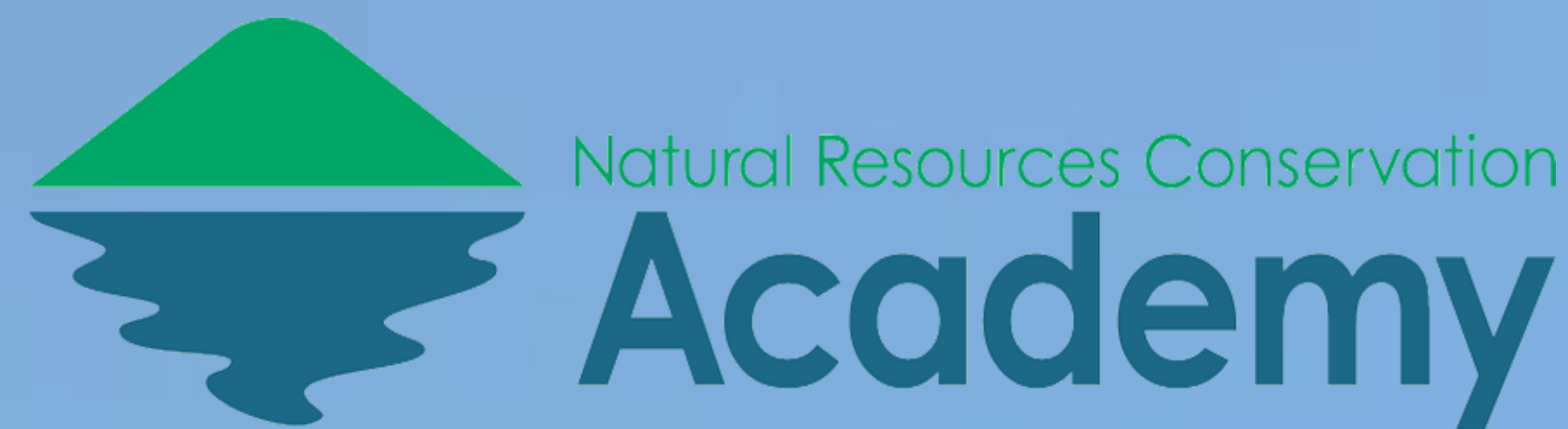


# The Importance of Dissolved Oxygen in the Long Island Sound

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## ABSTRACT

The Long Island Sound is a special part of our oceans called an estuary, where freshwater from rivers and streams mix with ocean salt water to form brackish water. The Long Island Sound teems with life due to this brackish water. Like most organisms on earth fish, lobster, and other underwater animals require oxygen to survive. Knowing the dissolved oxygen (DO) is crucial for humans to help maintain this abundance of life in the sound. When DO levels go down too low <2-3 mg/L that area of water is considered hypoxic. Estuaries such as the LIS are more prone to hypoxia/hypoxic events due to lack of circulation and nitrogen runoff from fresh water streams causing algae blooms. Hypoxia in the LIS is dangerous to its inhabitants and subsequently hurts its 17 billion dollar economic value. Hypoxic events can last for weeks to months on end affecting large areas of the LIS, including private farms. Knowing the root cause of such problems through DO monitoring is important for us as humans to protect this resource for future generations to use.

Using daily DO recordings collected by a MYSound device, I evaluated changes in DO levels in the Long Island Sound near Norwalk, CT from 2012 to 2015. Specifically, I addressed the following questions:

- 1) Do hypoxic events occur in the Long Island Sound?
- 2) How prolonged are these events?
- 3) What time of year do these events occur?

I found that hypoxia does occur regularly in the Long Island Sound, and that these events normally occur for months and during <insert time of year e.g. summer>. I raised awareness of the issue with hypoxic events in the Long Island Sound at a Maritime Aquarium Fish School event.



Fig 1. Large fish die off in Glen Cove Creek, Long Island

## INTRODUCTION

Why is Dissolved Oxygen (DO) Vital for Aquatic Ecosystems?

- DO (oxygen dissolved in water) is vital because the majority of organisms on earth require oxygen to survive and thrive, including important fisheries species such as fish, crab, and lobster.
- When DO levels fall into hypoxic levels mass die offs occur. (Fig. 1).

What is Hypoxia?

- Hypoxia is the condition for when DO levels in bodies of water drop below 2-3 mg/L.
- This condition indicates when an area or body of water is unable to support life.

What Causes Hypoxia?

- Nitrogen Runoff from farms
- Decay of Algae

Why Study Hypoxia in LIS?

- Estuaries are one of the most biodiverse ecosystems in the world
- Estuaries need to be preserved
- LIS is the basis of a 20 billion dollar economy annually because of the fisheries industry.
- Therefore, it is vital to know the extent to which hypoxia is occurring in LIS as this effects the lives of millions of people both economically and ecologically.

Project Objectives/Goals:

- Evaluate the extent to which hypoxia occurs in the Long Island Sound in Norwalk, CT.

## METHODS

### Data Collection

- Data was collected by the *Norwalk Harbor MYSound Device*
- *MYSound* (Monitoring Your Sound) device collects real-time weather and water quality data throughout the Long Island Sound.
- The analysis focused on data collected near Norwalk, Connecticut by the Maritime Aquarium.

### Data Analysis

- First, I gathered the daily 24-hour graph outputs of DO readings from 2012 to 2015 (Fig. 2).
- Next, I manually recorded the maximum and minimum DO values from the output graphs for each day.
- Subsequently, graphed and reviewed for trends to evaluate the following:
  - 1) Do hypoxic events occur in the Long Island Sound?
  - 2) How prolonged are these events?
  - 3) What time of year do these events occur?

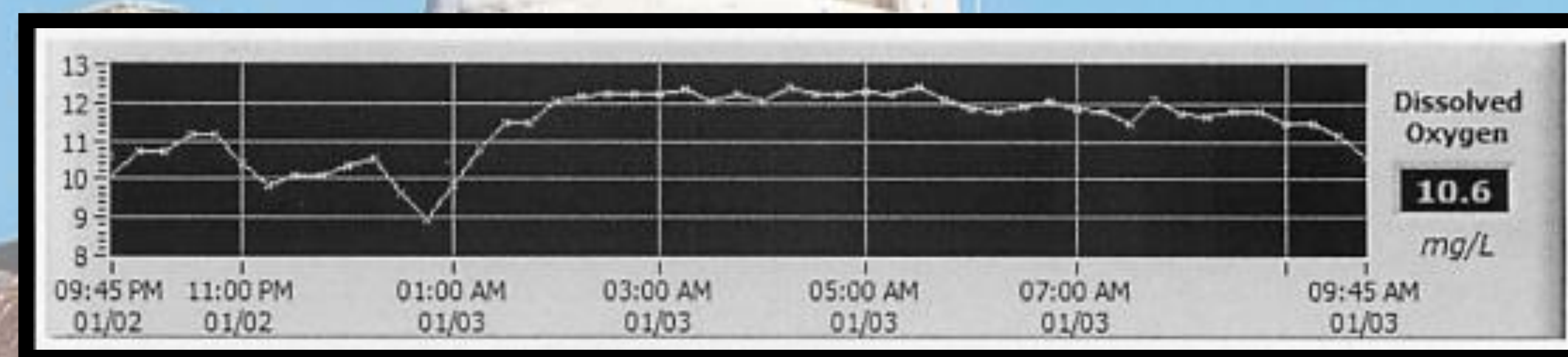


Fig 2. Example of a graphical output for dissolved oxygen (DO) readings from the MYSound device. This example has a maximum DO reading of 12.2 Mg/L and a minimum DO reading of 9 Mg/L.

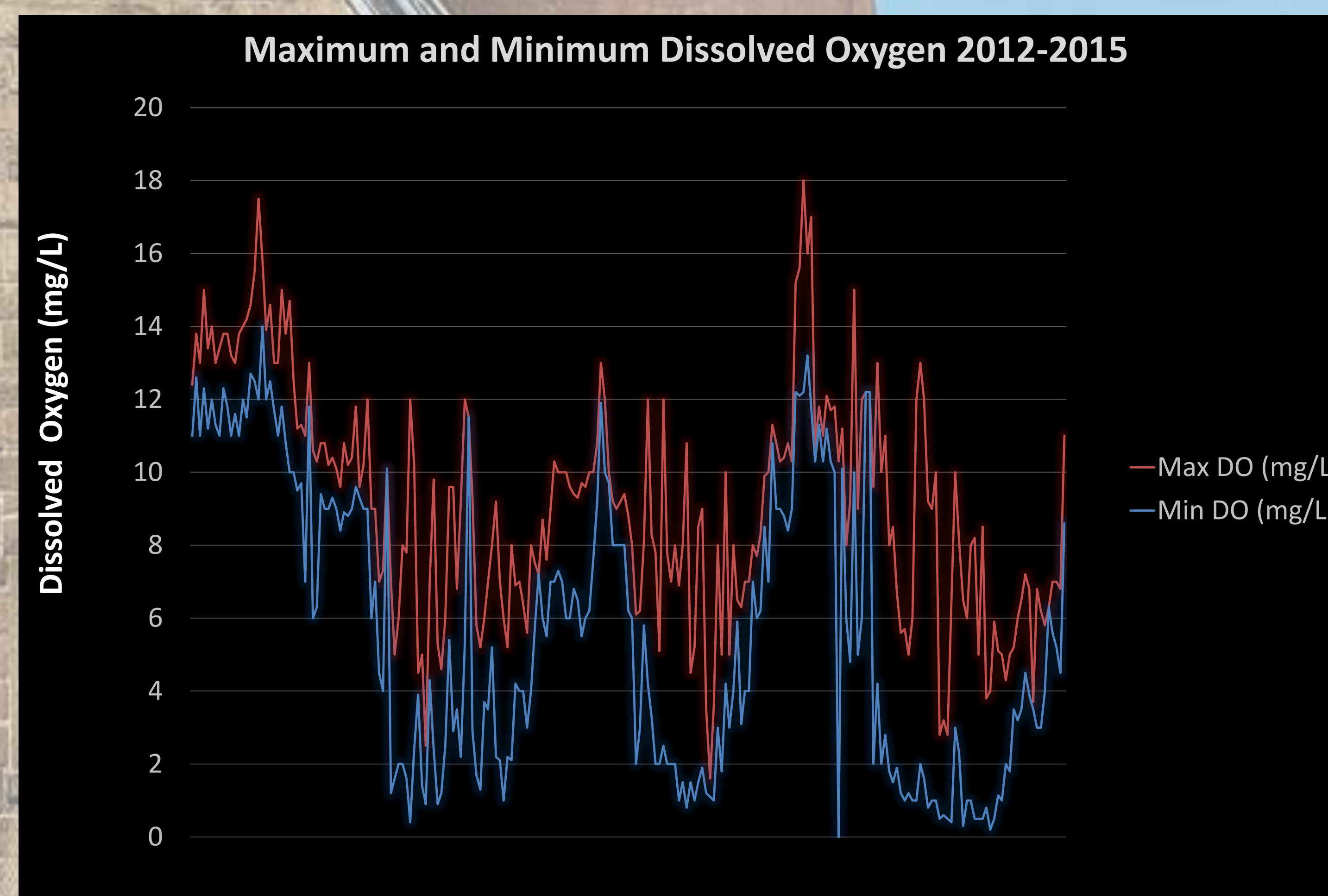


Fig 3. Three years of variation in maximum and minimum dissolved oxygen levels recorded by the MYSound device managed by the Maritime Aquarium.

## RESULTS

In the Long Island Sound (LIS) near Norwalk, CT, from 2012 to 2015, DO levels were consistently low each year, which indicates that hypoxia occurs regularly in the LIS and thus, is a issue in this part of the Sound (Fig 3).

The most striking finding is that there were a couple days when even the maximum DO

## RESULTS CONTINUED

### Do hypoxic events occur in the Long Island Sound?

- Yes. Figure 3 shows that in the past three years, DO levels are consistently low during the winter months and dip into hypoxic levels daily.
- There were days when both the maximum and minimum DO levels fell into the hypoxic range (Fig. 3).

### How prolonged are these events?

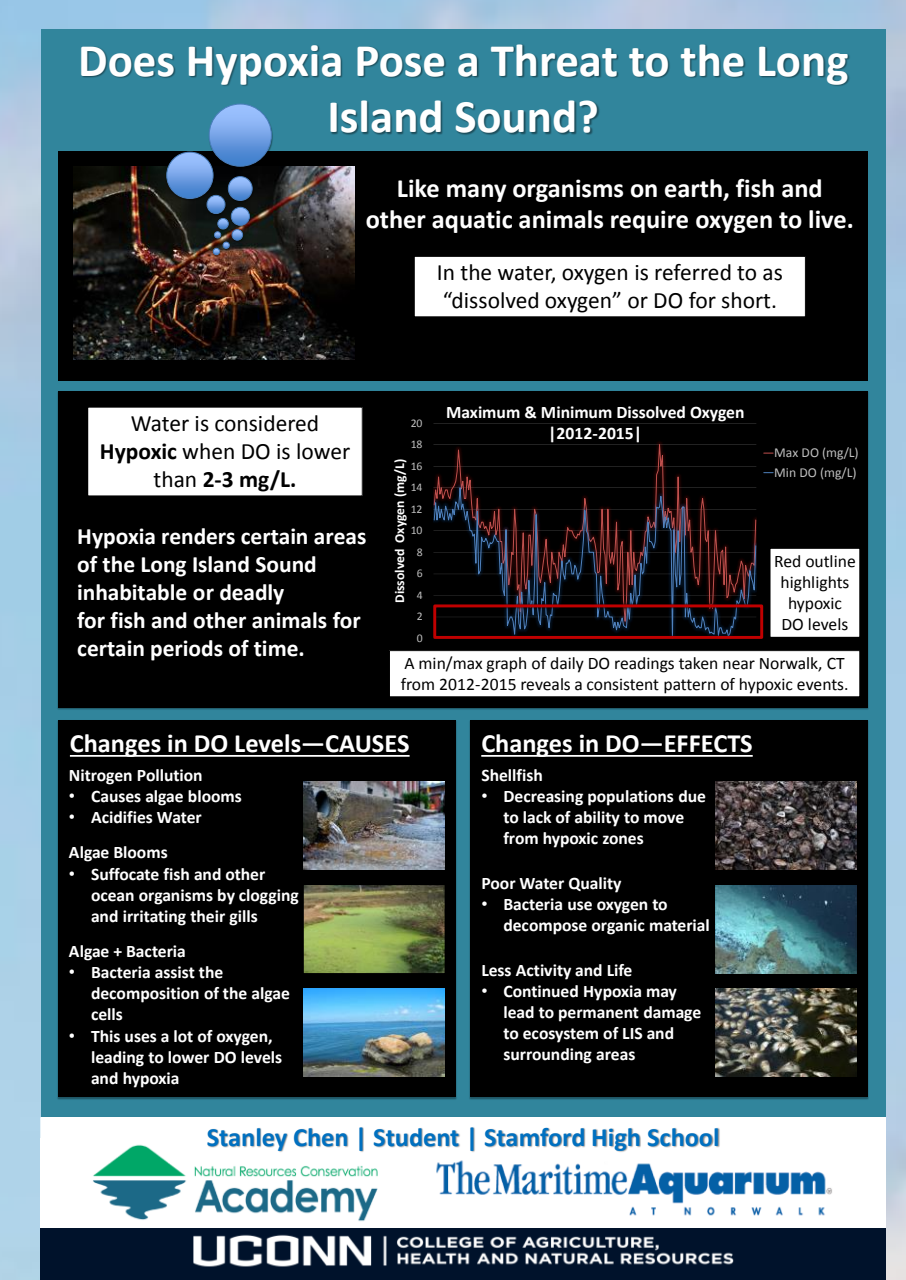
- These hypoxic events usually last from a couple hours at a time to

## Public Awareness

- I created an educational poster displaying these findings and presented it at the Fish Day event at the Maritime Aquarium of Norwalk, CT on February 24, 2016 (Fig. 4).
- I discussed my findings with over 50 educators attending the event.



Fig 4. Presenting findings at *Fish Day* (Feb 24, 2016) at the Maritime Aquarium in Norwalk, CT.



## CONCLUSIONS & FUTURE RESEARCH

Over the past 3 years there have been numerous large fish die offs ranging from fish die offs in Glen Cove Creek, Long Island, NY (Fig. 1) to lobsters in Norwalk, CT. These die offs may be attributed to hypoxic events that occur throughout the LIS. Nevertheless, it is important to recognize that the findings from this study are not necessarily representative of the entire the Long Island Sound.

### Future Research

- Determine potential money loss annually due to hypoxia.
- Determine root cause of hypoxic events.
- Work alongside CT Department of Energy and Environmental Protection (DEEP)
- Create plan of action/proposal for the CT DEEP.
- Provide further suggestions for improvement of the DEEP Monitoring Water Quality System.

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