How Clean Is My Water?

2016 Water Quality Year-In-Review, Water Monitoring Team

In 2016, GBF's Water Quality Monitoring Team collected and analyzed 444 water samples from 51 sites around Galveston Bay. These samples were collected by 47 different volunteer monitors who sampled for air and water temperature, dissolved oxygen, pH, salinity, water transparency and depth, as well as general field observations. For more information about this program, visit www.galvbay.org/watermonitors.

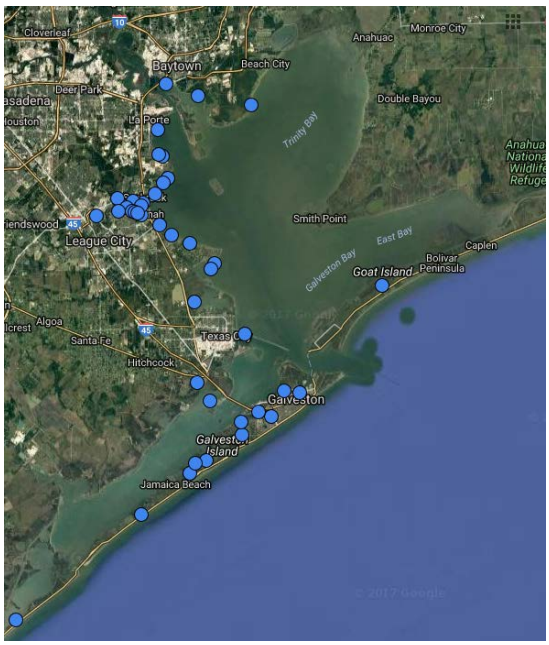


Figure 1. 2016 Water Monitoring Locations. Each blue dot represents a sampling location during 2016.

This document summarizes our findings for each parameter based on the Team's 2016 data.

To view 2016 Water Quality summaries for each individual site, please click on each site on our sampling map*, linked here or accessed from our webpage (www.galvbay.org/watermonitors).

This data can be viewed and downloaded from the Citizen Science Data Portal, accessed through a button on our webpage (listed above).

**Sites on map without 2016 data summary are new as of 2017*

Air Temperature: average of 24.0°C in 2016

This is **HIGHER** than in previous years

2014 average: **22.4°C**, 2015 average: **23.1°C**

How does Water Temperature Impact Water Quality?

Air temperature impacts water quality by influencing weather processes and water temperatures.

According to the Data…

GBF's Water Monitoring Team has observed a slight increase in the air temperature from year to year, with 2016's temperature the highest yet.

Water Temperature: average of 22.8°C in 2016

This is **HIGHER** than in previous years

2014 average: **21.9°C**, 2015 average: **22.8°C**

How does Water Temperature Impact Water Quality?

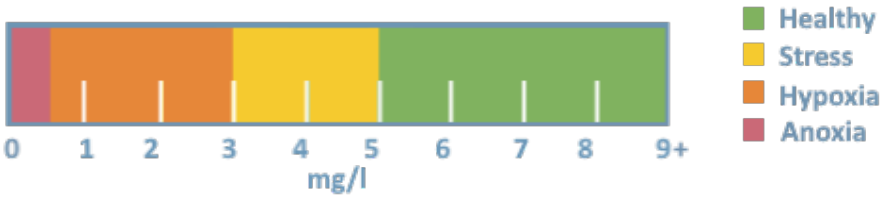
Water temperature can impact biological factors, including hibernation, reproduction, and migration..

Water temperature also impacts water chemistry. It can alter the rate of reactions and how much dissolved oxygen the water can hold; cold water can hold more oxygen than warm water.

According to the Data…

GBF's Water Monitoring Team has observed a slight increase in the average water temperature from year to year, with 2016's temperature the highest recorded.

Dissolved Oxygen: average of 6.3 mg/L in 2016



This level is **GOOD** for supporting animal life.

99 percent of samples had Dissolved Oxygen levels high enough to support life in 2016.

What is Dissolved Oxygen (DO)?

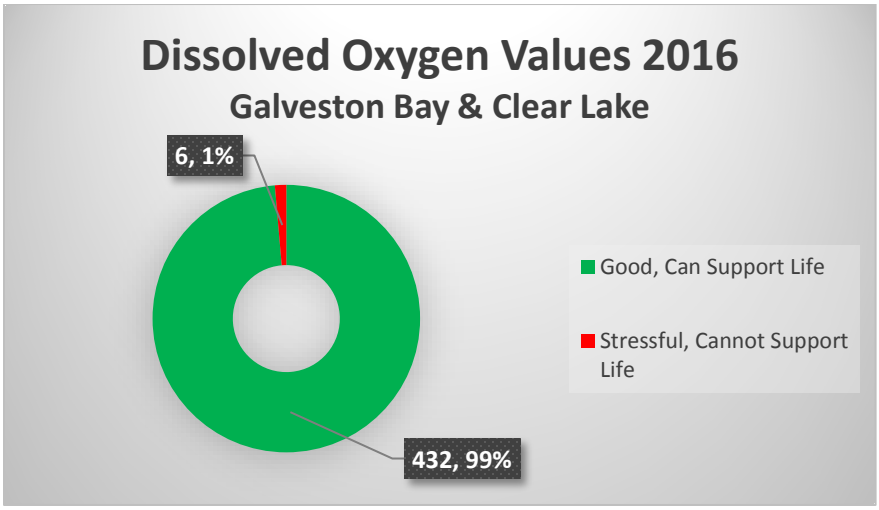
Dissolved Oxygen (DO) concentrations tell us the amount of oxygen freely available in the water.

How Does DO Impact Water Quality?

Fish and other aquatic life depend on dissolved oxygen to survive; if oxygen levels are too low they will suffocate. DO levels of 5 mg/L or higher are required for healthy growth and activity. Levels between 3 and 5 mg/L are stressful to most aquatic animals, and levels below 3 mg/L are considered dangerous (Figure 1).

According to the Data…

In 2016, 99 percent of the DO samples collected by GBF's Water Monitoring Team were 5 mg/L or higher. This indicates that DO levels are suitable for life within Galveston Bay.

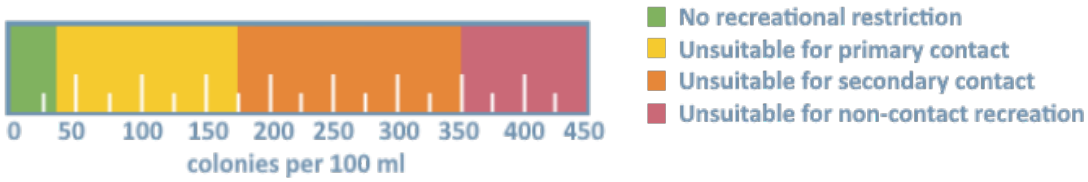


Enterococci Bacteria: Geometric Mean of 6.5 MPN in 2016

This is considered **SAFE** for swimming by the EPA (<35 MPN is safe to swim)

This level is **LOWER** than previous years

2014 geomean: **7.8 MPN**, 2015 geomean: **12.8 MPN**



What are Enterococci?

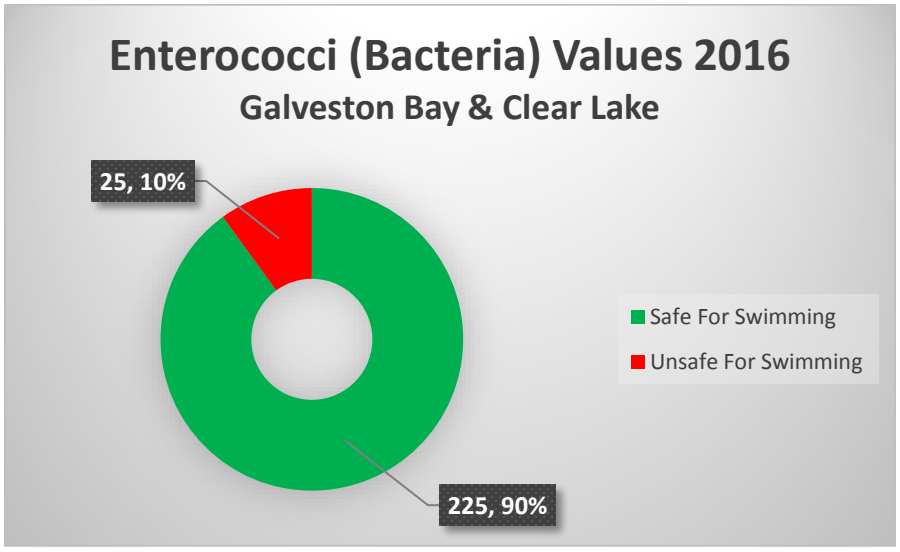
Enterococci are a group of indicator bacteria that indicates the presence or absence of fecal matter in the water and the potentially harmful microorganisms associated with fecal waste.

How do Enterococci Impact Water Quality?

Enterococci in the water indicate the presence of microbes from fecal matter that can make us sick and impact Galveston Bay's oyster and tourism economy. Fecal matter enters our waterways through polluted storm water, failed wastewater infrastructure, and from pets and wildlife, to name a few.

According to the Data…

About half of GBF's Water Monitoring sites test for Enterococci. Of the 250 samples collected in 2016, 10 percent of them were considered unsafe for swimming by the EPA. Most of these exceedances occurred soon after major rain events.



Salinity: average of 11.9 ppt in 2016

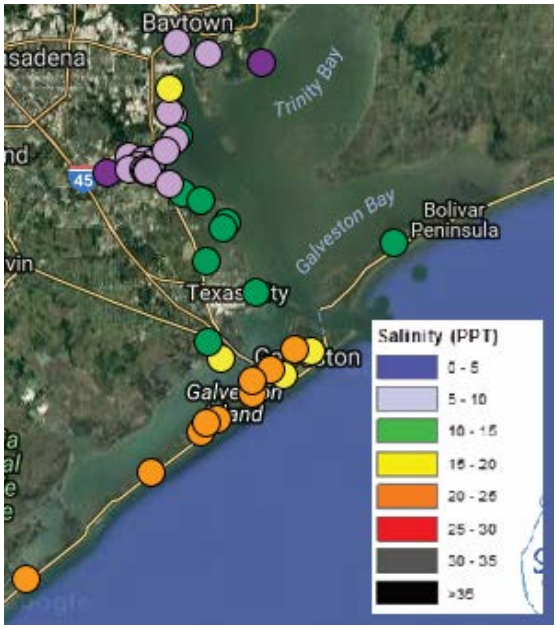


Figure 2.. Salinity averages by site, 2016.

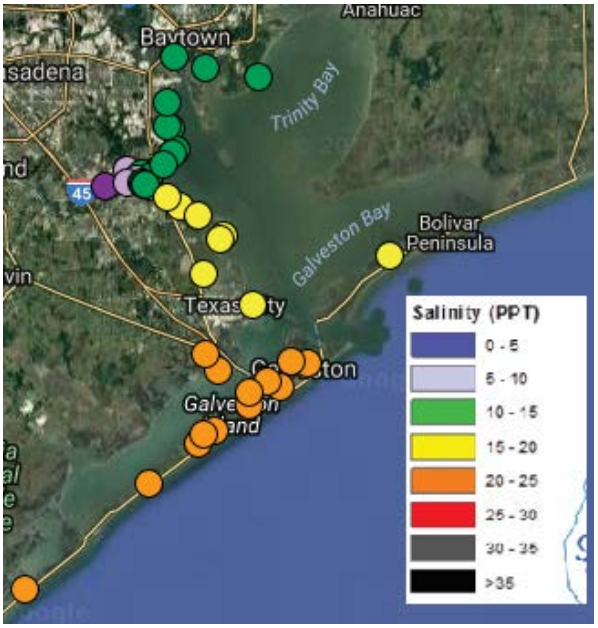


Figure 3. Salinity averages by site, normal year

This is **LOWER** than previous years

2014 average: **19.11 ppt**, 2015 average: **12.45 ppt**

What is Salinity?

Salinity is the total amount of salts dissolved in the water. Fresh water usually has a salinity of 0 ppt, while salty ocean water usually has a salinity around 35 ppt.

How Does Salinity Impact Water Quality?

Galveston Bay's water comes from freshwater rivers and bayous as well as from inflows from the open ocean. Because of this, Galveston Bay should have brackish water, between salty and fresh.

Salinity within Galveston Bay generally ranges over space and time. Impacts on salinity include proximity to freshwater inflows and seawater exchange, rainfall, and tidal patterns.

Plant and animal life within Galveston Bay rely on a specific range of salinity; water that is too salty or too fresh makes it difficult for life to thrive in Galveston Bay.

According to the Data…

GBF's Water Monitoring Team found that Galveston Bay experience fresher water overall in 2016 than what is considered normal. Many sites reported the lowest salinities ever recorded at their site. This is likely due to the rain and flooding experienced over the spring and summer.

Water Transparency: average of 0.5 meters in 2016

This is **THE SAME** as in previous years

2014 average: **0.55m**, 2015 average: **0.46m**

What is Water Transparency?

Water transparency, or turbidity, measures how much solid matter is suspended in the water. It directly measures how these suspended solids decrease light passing through the water. The higher the transparency, the farther down the light passes and the clearer the water appears.

How Does Water Transparency Impact Water Quality?

Turbid waters can prevent plants from getting enough sunlight to grow, and settling sediment can bury or suffocate plants and animals living on the bottom of the Bay.

Galveston Bay's turbid waters are due to:

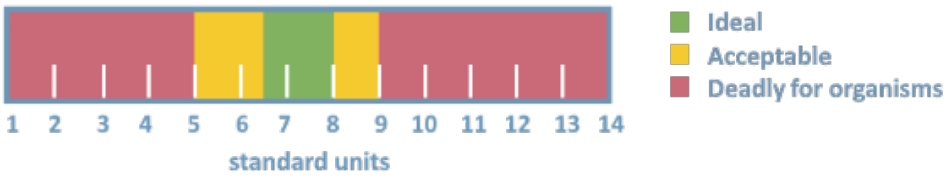
- *sediments from the Bay Bottom mixing in the water column*
- *erosion of the surrounding land*
- *vegetation (ie. plankton, algae) growing in the water column.*

Galveston Bay and the surrounding land has very small sediment particles, so sediment often floats in the water for a long time before settling to the bottom. This, coupled with a shallow and windy bay system, naturally leads to relatively turbid water in Galveston Bay. However, increased erosion due to development and storm water runoff can increase the amount of particles in the water column, causing the water to be more turbid (or less clear).

According to the Data…

In 2016, the average transparency measured by GBF's Water Monitoring Team was 0.5 meters, very similar to transparency measured in prior years.

pH: average of 7.9 in 2016



This is **IDEAL** to support life

This is **THE SAME** as in previous years

2014 average: **8.1**, 2015 average: **7.9**

What is pH?

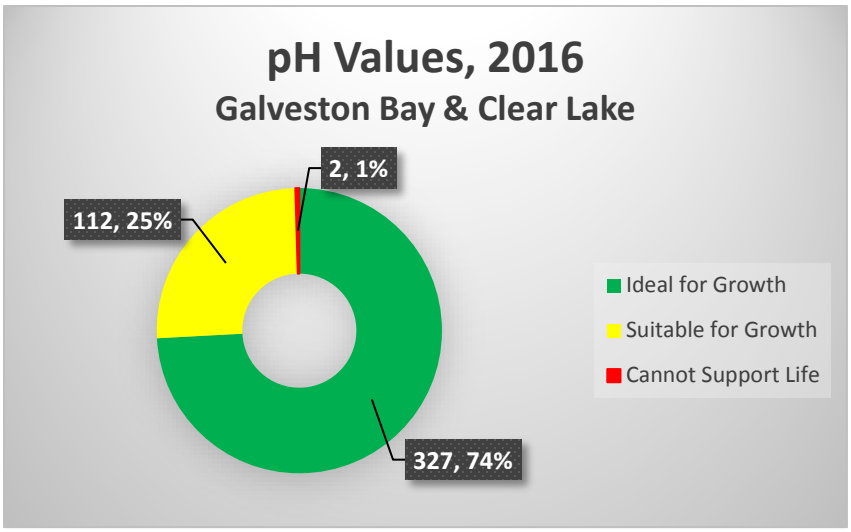
pH is a measurement of how acidic the water is. A pH with a measurement of 7 is considered neutral. Anything less than 7 is acidic, anything greater than 7 is basic. The scale is logarithmic, so every one-unit change equals a ten-fold increase or decrease in acidity.

How Does pH Impact Water Quality?

pH impacts the life and growth rates of aquatic life, how chemicals and pollutants dissolve or react in water, and whether or not these pollutants can be absorbed by animals in the water. A range of 6.5 to 8 is considered ideal for most life. A pH less than 5 or greater than 9 is considered dangerous or deadly.

According to the Data…

pH has been relatively stable in Galveston Bay over the years, and is considered within a healthy and normal range.



Acknowledgements

Thank you to all 44 volunteer water quality monitors for dedicating their time and effort to collecting this data. A special 'thank you' to GBF's two volunteer lab assistants, Dave and Casandra, for spending countless hours in our lab processing and analyzing enterococci samples.

Additionally, thank you to Lindsey Fuchs, a student from Clear Horizons High School, for assembling the bar graphs featured in this publication that show ideal ranges for dissolved oxygen, enterococci, and pH. Lindsey also conducted water quality testing on a weekly basis throughout her Fall 2016 semester.

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