Little Bay Water Quality Report Card
Winter 2013

Little Bay is a small, semi-enclosed estuary located in the heart of Rockport, Texas. Estuaries, where freshwater from rivers and streams mixes with salt water from the oceans, are extremely productive and valuable ecosystems that provide flood protection, filter nutrients and contaminants, and provide valuable habitats for wildlife, including nursery areas for many commercially and recreationally important fishes and invertebrates. Little Bay has been an important part of the Rockport community for many years. It not only provides the important ecological functions mentioned above, but it also supports the local tourism industry by providing opportunities for both residents and visitors to fish, kayak, boat, jet-ski, and watch birds.

Water quality station in Little Bay, Rockport.

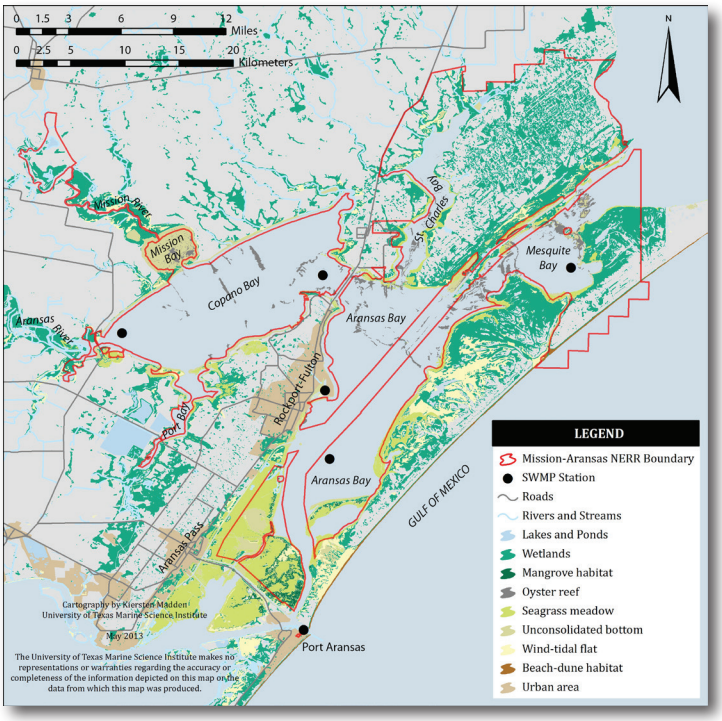
For the last few years, there has been growing concern about the "health" of Little Bay. Many long-term residents and visitors have noted marked changes in the habitats and wildlife of Little Bay. They are worried about Little Bay's ability to function properly and to continue to support the recreational activities which have made it such a popular destination for both residents and visitors. Various monitoring programs, including seagrass and water quality monitoring projects, have been conducted in Little Bay and its tributaries to try and understand the recent decline in environmental quality of Little Bay. However, definitive explanations for the declines witnessed in Little Bay have not been found and further long-term monitoring efforts would be useful.

In 2012, the Mission-Aransas National Estuarine Research Reserve proposed the idea of establishing a "Report Card" to monitor the long-term health of Little Bay. Report cards are an effective way to portray the changing conditions of the estuary and have been used in several bays throughout the United States, including the heavily-impacted Chesapeake Bay system.

The Little Bay Report Card includes measurements of water quality and is based on the following parameters: temperature, salinity, dissolved oxygen, turbidity, and chlorophyll. Water quality is compared to measurements taken in Aransas Bay. This comparison with Aransas Bay will be used to provide a "grade" for each parameter and will be factored into an annual score. Aransas Bay is generally regarded as a "healthy" bay with good water quality and healthy habitats.

Water quality station in Aransas Bay.

The information provided in this report includes a quarterly review of all water quality parameters, except nutrients. The information presented is a summary of water quality data collected by the Mission-Aransas Reserve. The Mission-Aransas Reserve manages five data-logging stations throughout the estuary and one in Little Bay. Each site contains a data logger that collects water quality information at 15 minutes intervals throughout the year. The data for five stations, not including Little Bay, are available online at: nerrsdata.org



Water quality station locations operated by the Mission-Aransas Reserve.

Water Quality Indicators - Winter 2013

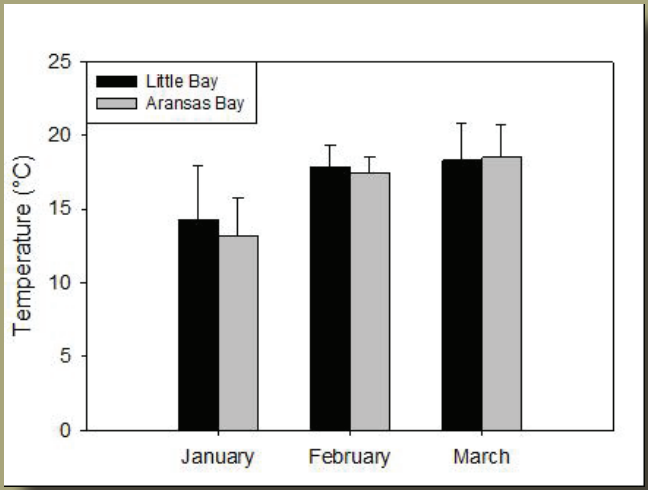
Positive: Parameter indicates generally good or improving conditions relative to Aransas Bay.

Cautionary: Parameter indicates potentially deteriorating conditions relative to Aransas Bay; however, additional information or data are needed to fully assess the indicators response.

Negative: Parameter indicates poor or deteriorating conditions relative to Aransas Bay.

TEMPERATURE

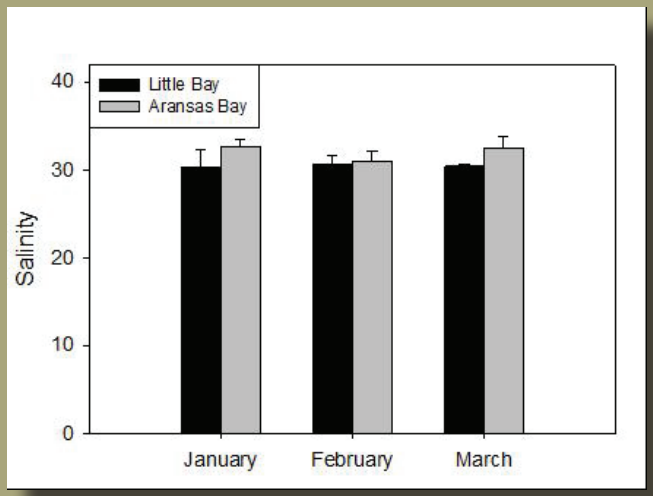
Water temperature is an important indicator of the health of estuarine systems because of the direct relationship between water temperature and oxygen. As water temperature increases, the amount of oxygen that can be dissolved in the water decreases. Additionally, all plants and animals have a range of temperatures in which they thrive. Therefore, temperature determines what types of plants and animals are able to survive in the estuary. If the water in the estuary is outside the normal seasonal temperature range for which local organisms are adapted, it is most likely an indication that something is adversely affecting the health of the estuary. As a result, seasonal water temperature is an important indicator of habitat quality for many estuarine species.



Comparison of mean monthly temperature in Little Bay and Aransas Bay from January to March 2013 showed no significant differences. We would generally expect Little Bay to experience greater temperature extremes as it is shallower and more confined in comparison to the larger and more open Aransas Bay. The measured temperatures do not indicate a concern for water quality.

SALINITY

Salinity refers to the amount of dissolved salts in seawater. Salinity levels in an estuary vary daily, seasonally, geographically, and with tidal cycles. Salinity levels in estuaries can rise on hot sunny days when evaporation removes fresh water and leaves behind the salt. Conversely, salinity is reduced by large amounts of rain and increasing freshwater inputs from rivers and creeks. Salinity gradients exist throughout an estuary, from the river mouth to the open ocean. Salinity levels are generally highest near the area where saltier water enters, and lowest upstream where freshwater flows into the estuary. Since salinity has major effects on physiological processes, salinity levels greatly influence the species of plants and animals that inhabit an area.

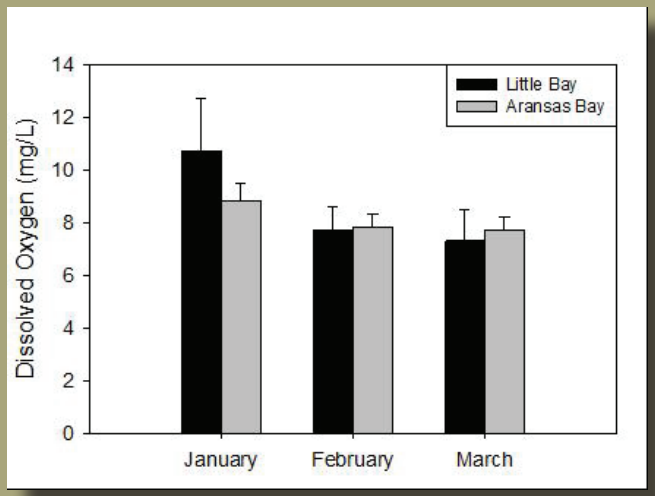


Comparison of mean monthly salinity from January to March 2013 showed no significant differences. We would generally expect Little Bay to experience lower salinities due to increased freshwater run-off from the surrounding area and point sources such as Tule Creek and storm drains. Little Bay is also a confined system with less potential water exchange than Aransas Bay.

Water Quality Indicators - Winter 2013

DISSOLVED OXYGEN

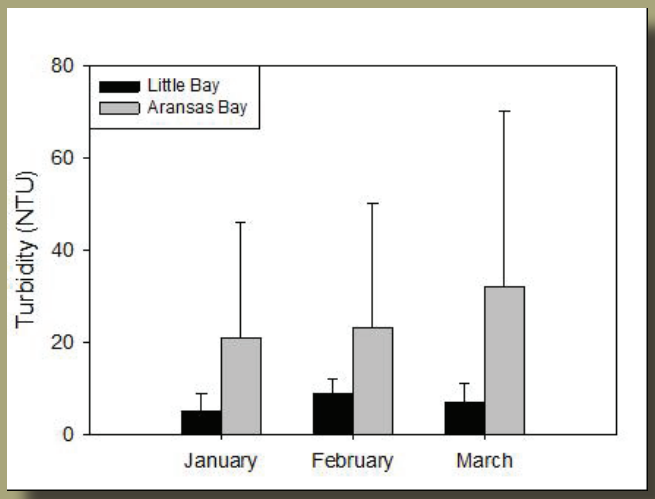
Dissolved oxygen (DO) refers to the oxygen that is available to aquatic organisms for respiration. Oxygen enters the water through two natural processes: diffusion from the atmosphere and photosynthesis by aquatic plants. The mixing of surface waters by wind and waves increases the rate at which oxygen from the air can be mixed into the water. Oxygen concentrations in estuarine waters undergo both daily and seasonal fluctuations due to changes in the tides, temperature, and plant photosynthesis. Oxygen levels typically peak during the daylight hours as plants are photosynthesizing and decrease at night when photosynthesis ceases and both plants and animals consume oxygen through respiration. Very high levels of DO, or supersaturation, can actually be harmful, causing capillaries in fish gills to rupture or tear. Low levels of DO are an even greater concern in estuaries when they create a condition known as hypoxia. Hypoxic conditions tend to support a lower diversity of species. Therefore, proper DO levels are critical to maintaining estuarine health.



Comparison of mean monthly dissolved oxygen concentrations from January to March 2013 showed no significant differences in February and March, but higher levels in January. The increased DO concentrations in January can most likely be attributed to the colder temperatures and lower salinities in Little Bay during that month - colder, less salty water and hold more dissolved oxygen. The measured dissolved oxygen levels do not indicate a concern for water quality.

TURBIDITY

Turbidity is a reduction in the clarity of water due to the presence of particles suspended in the water column. Sediments, such as silt and clay, are generally transported into the estuary by river systems and are responsible for high turbidity conditions, although phytoplankton or other organic material can also contribute significantly to turbidity. High turbidity limits the amount of light that can penetrate through the water, which can influence the vertical distribution and productivity of phytoplankton, seagrasses, and large algae (or macroalgae). This, in turn, affects other organisms that depend on these plants for food and oxygen. Scientists often consider turbidity of the water in connection with other factors to get a better understanding of its causes and consequences. For example, high levels of turbidity can indicate problems with shoreline erosion, or malfunctioning sewage treatment facilities.

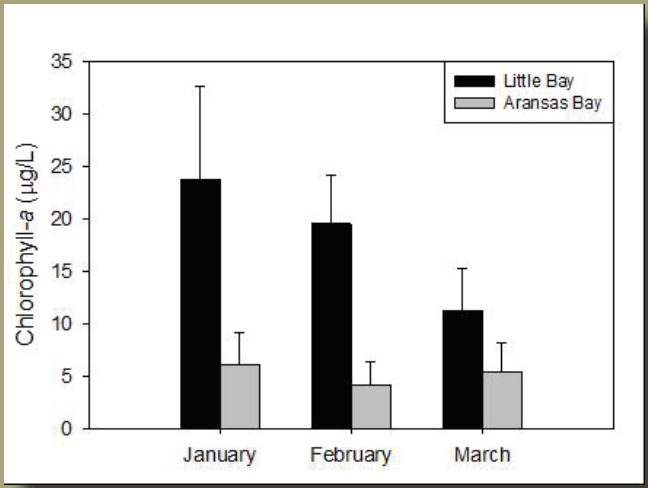


Comparison of mean monthly turbidity levels from January to March 2013 showed significantly lower turbidity in Little Bay than in Aransas Bay. As a shallow water body, Little Bay can be more affected by seasonal shifts in weather patterns and impacts of wind than in the larger Aransas Bay. However, because Little Bay is smaller, it is also more protected from wind. It is likely that the seasonal wind pattern (north in winter fronts, and south east the rest of the year) is the cause for the difference in turbidity. The measured turbidity levels do not indicate a concern for water quality.

Water Quality Indicators - Winter 2013

CHLOROPHYLL

Chlorophyll is a green-colored pigment that plants use to make their own food using the sun's energy and nutrients in a process known as photosynthesis. In the ocean and estuaries, microscopic plants, known as phytoplankton, are suspended in the water column and use chlorophyll to photosynthesize. By measuring the amount of chlorophyll in an estuary, scientists can quantify the levels of phytoplankton and estimate the photosynthetic activity in the water. Chlorophyll levels can vary seasonally, with higher levels measure in the sunny, summer months when phytoplankton are actively photosynthesizing. However, high chlorophyll levels can also indicate high levels of storm water runoff or other sources of excess nutrients entering the estuary. After a heavy rain, nutrient-loaded runoff from roads, farms, building sites, and poorly designed sewage treatment systems can enter the estuary and cause phytoplankton blooms, which ultimately can lead to depleted dissolved oxygen levels and even fish kills. Thus, chlorophyll measurement can be utilized as an indirect indicator of nutrient levels.



Comparison of mean monthly chlorophyll concentrations from January to March 2013 showed that phytoplankton (or algal) biomass was consistently significantly higher in Little Bay than in Aransas Bay. This is likely attributed to nutrient loading from run-off or the Tule Creek outfall into a relatively small bay with limited water exchange.