Cattail Wetlands Field Exercise

Cattail Marsh

The Cattail marsh is a 900-acre wetland complex that was constructed in 1993 to provide the final filtration stage for wastewater effluent from the Beaumont. After the water is treated at the wastewater treatment plant to the northeast, it is pumped into the northeastern cell of the wetland (cell 1 in the image to the right). This cell is mainly open water and allows for the dissipation of disinfectants, such as ammonia and chlorine, used in the treatment process (J. Liao, personal communication). From this cell, water is pumped into one of the remaining cells (cells 2-8 in the image to the right) in the wetland. The water slowly moves completely through the cell and then is pumped into Hildebrandt Bayou next to the marsh. Each cell consists of a series of open water pools and shallow marshes or mudflats. As water moves through the cells, carbon, suspended solids, nutrients (N and P), metals, and potentially harmful bacteria are removed from the water via settling of sediments, plant uptake, and denitrification (Mokry 2014). In addition to providing filtration to Beaumont wastewater, the wetland has become a wildlife refuge with over 350 species of birds spotted in the refuge over the years (City of Beaumont 2016) and home to about 200 resident alligators (McLeod 2015). We will be sampling from cell 2, the cell nearest the parking lot. This field exercise seeks to determine how water quality changes along the length of a cell and how the change in water quality affects the aquatic organisms within the cell. We measure these changes by collecting data for:

1. Water chemistry
2. Aquatic macroinvertebrates
3. Algal density (measured via chlorophyll *a*)

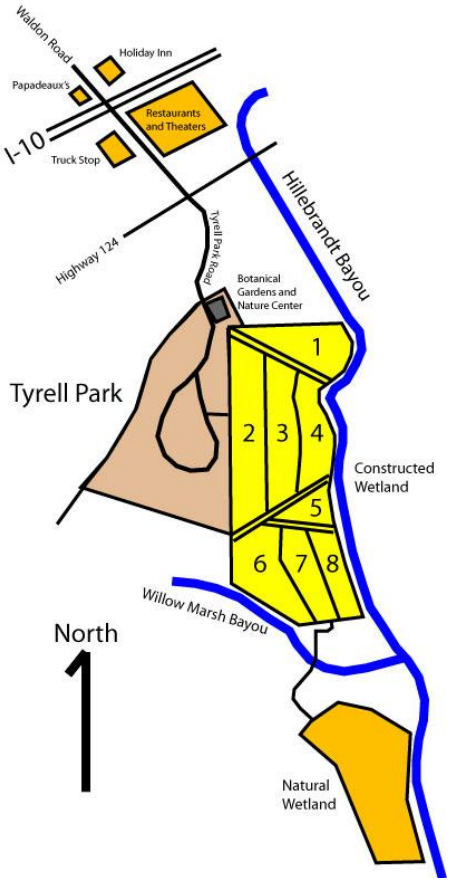

Image from the Golden Triangle Audubon Society http://www.goldentriangleaudubon.org/focus-areas/cattail-marsh/

Overview of field equipment

Chemical Measurements

Hanna Multiparameter Sonde

The Hanna simultaneously measures five important physicochemical variables in limnology. This submersible instrument measures water temperature, pH, conductivity, dissolved oxygen (DO) and turbidity. The interpretation of temperature is straightforward. Dissolved oxygen is amount of oxygen that is dissolved in the water. It can be measured as a concentration or as a percentage of the oxygen in the atmosphere. We will use the latter measurement. pH is the measure of the acidity or alkalinity of a solution, specifically the activity of dissolved hydrogen

protons in the solution. A lower pH means the water is more acidic. Conductivity is an indicator of the concentration and activity of charged ions in the water. Conductivity is usually highly correlated with the amount of salts and total dissolved solids substances in the water. Turbidity is a measure of how clear a fluid is. The higher the turbidity, the less clear the fluid.

Macroinvertebrate Sampling

Macroinvertebrates are major component of animal life residing in wetlands, streams, and along the littoral zone of lakes. Macroinvertebrates provide food for fish, birds, and other vertebrates. The type of macroinvertebrates residing in an aquatic community can tell us something about the water quality of that site. Some macroinvertebrates are extremely sensitive to pollution or disturbance and are only found at pristine, undisturbed sites. Other macroinvertebrates are very tolerant of disturbance and pollution and can become abundant at extremely disturbed sites. The community composition of macroinvertebrates at a site reflects its water quality. The most common aquatic macroinvertebrates include insects, crustaceans, mollusks, and segmented worms. We will take qualitative (i.e., not over a specific surface area) samples of macroinvertebrates using D-frame dipnets.

Chlorophyll *a* Sampling

Planktonic algae (i.e., algae floating in the water column) have varying degrees of influence in aquatic ecosystems. Some eutrophic lakes and wetlands have massive algal blooms while many oligotrophic streams and lakes have little to no planktonic algae. The most precise way to estimate the amount of algae in an aquatic ecosystem is to count each algal cell in a water sample (we will do this for the Bigner Pond exercise). Another, faster way is to estimate the influence of algae in an ecosystem is to record the amount of chlorophyll *a* in a water sample. Chlorophyll *a* is the major molecule that absorbs energy from light in photosynthetic organisms. By measuring chlorophyll *a*, we can measure how much photosynthesis is occurring in the ecosystem.

Filtration apparatus

Samples for chlorophyll *a* must be filtered from water and frozen for later analysis. After we collect a water sample from the shore, we will extract all algal cells from water sample using a filtration apparatus. The filtration apparatus is assembled by:

1. The filter holder is inserted into the top of the flask.
2. A piece of A/E (1.0 μm pore size) filter paper is fitted on top of the base.
3. The graduated cylinder cup is placed on the base and held by magnets, holding the filter in place.
4. The water sample is poured into the graduated cylinder.
5. A handheld vacuum pump is connected via hose to the flask.
6. The pump extracts air from the flask, creating a vacuum that pulls water from the graduated cylinder through the filter and into the flask. The planktonic organisms remain on the surface of the filter paper.

Note: Do not exert too much force using the pump because excessive pressure can rupture cells on the filter, which will lead to some of the sample oozing through the filter and into the water in the flask. This loss will result in underestimations of chlorophyll concentration.

Description of Group Tasks

Chemistry Crews

Equipment
Hanna Multiparameter Sonde
LaMotte chemistry kits
Graduated cylinder (for Nitrate test kit)
1 glass jar for water collection
4 labeled waste jars

Activities

1. Using the Hanna at the edge of the wetland pool, record water temperature, pH, dissolved oxygen, conductivity, salinity, and total dissolved solids at edge of the wetland pond.
2. Using a glass jar, collect a water sample at the edge of the pool.
3. Using the water in the jar, perform the LaMotte tests of nitrate, phosphate, ammonia, and chlorine following the directions in the chemistry kits.
4. After each chemical analysis has been performed, put the waste in the appropriately labeled waste jar and rinse the tube with pond water.

Macroinvertebrate Crew

Equipment
4 D-frame dipnets
95% ethanol
500-micron sieve
1 Whirlpak per site
Ethanol bottle
Featherweight forceps

Activities

1. Using a d-frame dipnet, collect aquatic macroinvertebrates in vegetation.
    a. Vigorously push the dipnet against the bank of the wetland pool and the edge of the mudflat. Focus on the base of the wetted vegetation to collect macroinvertebrate samples.
    b. Dump all of the material in the net into the 500 micron sieve.
    c. Rinse the sieve multiple times in the pond to remove most sediment.
    d. Using 95% alcohol, rinse all the material in the sieve into a whirlpak and add more alcohol to completely cover the sample.
    e. Using the featherweight forceps, collect any macroinvertebrates attached to the sieve or net and place them in the whirlpak.
    f. Whirl the whirlpak to seal it.

Chlorophyll Crew

Equipment

Filtration apparatus
1 filter per site
1 tube per site
Foil
1 glass jar for water collection
Cooler with ice

Activities

1. Collect a phytoplankton sample
    a. Using a glass jar, collect a water sample at the edge of the pool.
2. Extract chlorophyll *a* from the sample
    a. Assemble the filtration apparatus.
    b. Pour water into the graduated cylinder. Pour in water up to the 500 mL mark.
    c. Begin pumping water into the flask. Do not exert too much force using the pump!
    d. Filter water until the filter looks greenish-brown. If the water has little phytoplankton, you may need to filter more than 500 mL. If pumping becomes difficult, stop before you damage the pump.
    e. Record the amount of water you filtered on the data sheet
    f. Remove the filter from the apparatus and roll the filter into a cylinder, being careful not to touch the sample.
    g. Place the filter into a plastic tube
    h. Label the tube and wrap it in foil.
    i. Put the tube in the cooler with ice.

References:

City of Beaumont. 2016. Coming Soon! Cattail Marsh Boardwalk & Viewing Platforms. Retrieved online on 2/11/16. http://www.beaumontcvb.com/blog/post/coming-soon-cattail-marsh-boardwalk-viewing-platforms/

McLeod, G. E. 2015. Day Trips: Cattail Marsh, Beaumont - Nature preserve offers up amazing sights. The Austin Chronicle, February, 13, 2015. Retrieved on 2/11/16. http://www.austinchronicle.com/columns/2015-02-13/day-trips-cattail-marsh-beaumont/

Mokry, L. 2014. Constructed wetlands: true green treatment technology. Online presentation. Retrieved 2/11/16. http://awra.tamu.edu/sites/default/files/2014-02-06%20Loretta%20Mokry%20(Alan%20Plummer)%20Constructed%20Wetlands.pdf