Four Year Honors Academic Program
Coastal Ecology &Environmental Studies
Biology, Chemistry,
Marine I &Marine II (Blocked)
APES , AP Bio and DE
Technical Equipment Training
2 Core multiyear community projects:
"Bringing Back the Bayous" (3B)
"Assessing Biodiversity and Abundance
of Near Shore Species" (D and A)

Goal for this Community Project

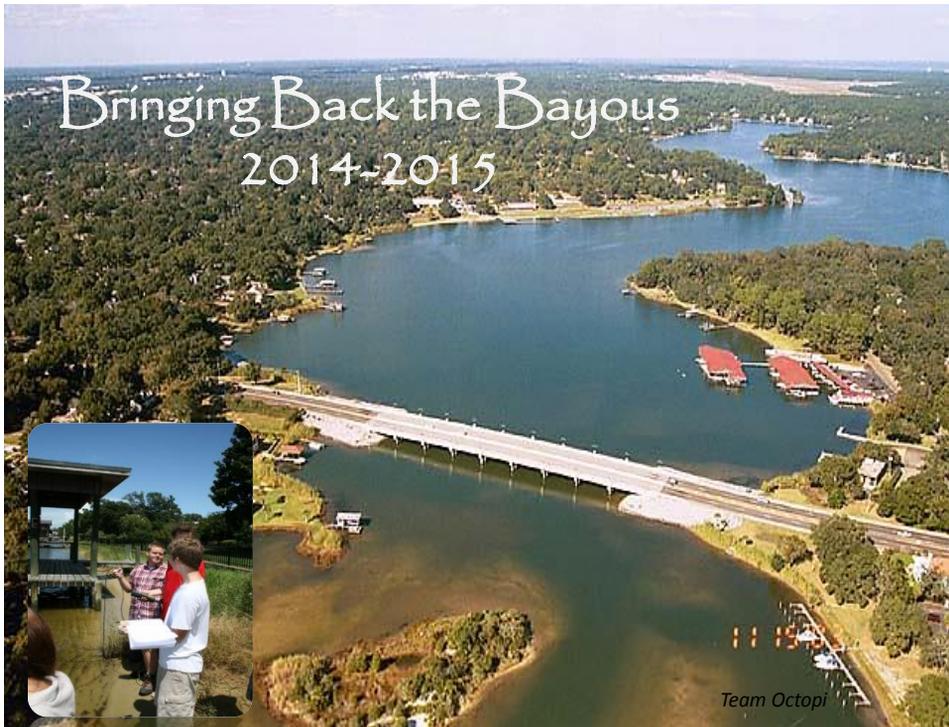Citizen Scientists will become stewards for local waterways with first hand knowledge:

Biogeochemical Cycle
Watershed
Nutrient Excess

Fieldwork & Lab Experience
Sampling Technique
Advanced Test Equipment

Community Involvement
Share Findings
Offer Solutions
Provide Next Step

Bringing Back the Bayous
2014-2015

Team Octopi

Project Summary

- **16 impaired bodies of waters**

- **Expand Bringing Back the Bayous Program (3B)**

- **Hot Spot (Nutrient Levels) :**

  Focus (thanks to MSA Senior Class) :

  Hyde Park Road

- **Possible solutions and Next Step**

  - **Florida Friendly Yards (UF/IFAS)**

  - **Living Shoreline (DEP)**

  - **Phytoremediation : Retention Ponds (SWAT)**

June recording abiotic parameters

Our Current Focus on Impaired Bodies of Water (Assessment/Water Testing)

- ▶ Bayou Chico - PHS
- ▶ Bayou Grande - EHS
- ▶ Perdido Bay – WFHS
- ▶ Site TBD - PFHS
- ▶ Carpenter Creek/Bayou Texar –BTWHS MSA

Haley in the field testing for phosphates using the Hach Colorimeter

Michael in the wet lab "running" Total Nitrogen

Reasons for water impairment:

- ▶ Heavy metal levels, for example mercury, a byproduct from industry (not a focus of this study)
- ▶ Nutrient/waste runoff from roads and lawns (focus for this study) :
- ❖ Organic Enrichment may cause:
  - Chlorophyll-a (algal blooms) ⟶ Oxygen Depletion ⟶ Fish Kills
 - Elevated fecal coliform ⟶ public health warnings

Seniors Cole, Chris, and Grant at Bayview Park

Why is nutrient runoff occurring ? Here is a little Bayou Texar history to explain …
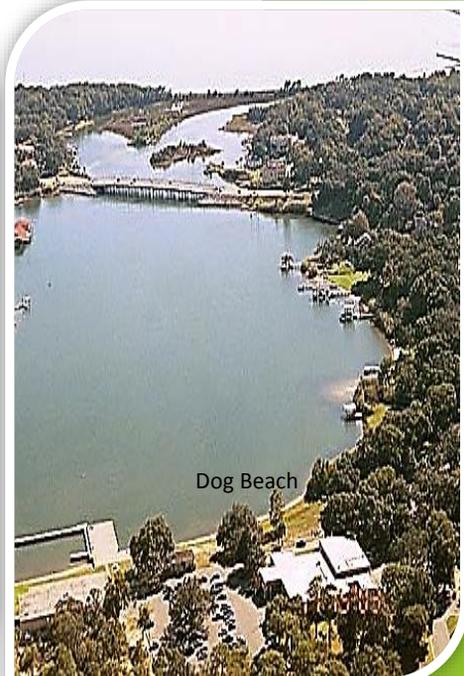

Native Vegetation

- ➢ 1950s – Housing subdivisions were built and native vegetation removal allowed runoff to enter the Bayou.

- ➢ Residents noticed poor water clarity

- ➢ SAVs began dying

- ➢ Fish kills began

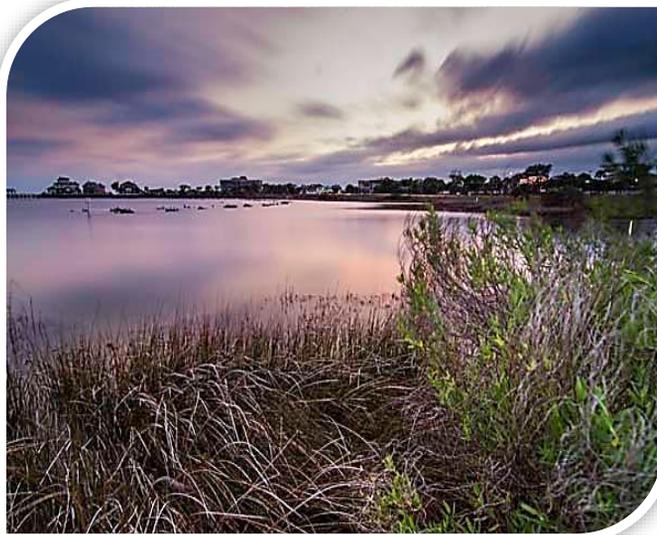- ➢ Health advisories were given due to high bacteria levels
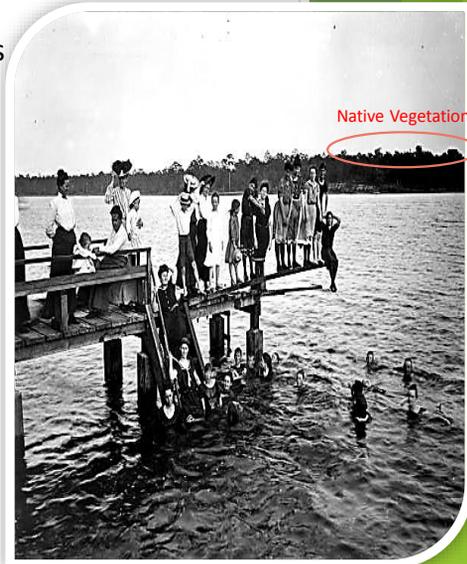
Bayou Texar Before…

Bayou Texar Now

Bayou Texar boat Launch

Dog Beach
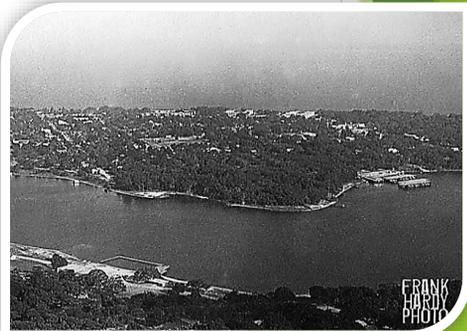
Methodology

Team Sunfish

Methods development and modification

- UWF
  - Dr. Matt Schwartz
  - Dr. Allison Beauregard
- Lakewatch
  - Secchi disk– turbidity
- DEP
  - Average DO readings at three depths
- Sea Grant
  - pH
- MSA Seniors (water sampling)

Sam using MSA seniors modified sampling method at Hyde Park Road

Parameters Measured / Data collected

- DO (Dissolved Oxygen)
- Salinity
- Temperature
- Turbidity (Secchi *Disk)*
- pH
- GPS
- Phosphates
- Total Nitrogen
  - Inorganic and organic
- Chlorophyll a

Grayson and Reilly using the YSI while Chris records DO, salinity, and temperature

YSI   **GPS**   **pH**

In Field Testing

- YSI: measures DO and salinity, (stands for yellow springs incorporated)
- **Turn on and calibrate <u>at least 5 minutes before sampling</u>**
  - Take three readings than average DO : Lower probe in water - 6 inches record DO, 12 inches record DO , than 18 inches DO, salinity and temperature readings.
  - Each reading may fluctuate some — allow reading to settle out
  - Clean up and stow
- Refractometer: measures salinity (for YSI backup)
- Secchi: measures turbidity
- All readings are recorded for publishing on MSA website and future analysis

The Ducks taking YSI readings at Hyde Park

Water Sample Preparation & Filtration

Work Station Set-up:

- Safety glasses
- Foil up work station
- Glove up.

Sarah placing filter on frit

Filter set-up:

- Connect vacuum pump tube to filter flask port
- Insert lower funnel piece (w/stopper) into flask.
- Verify that frit (black, plastic disk) is installed in lower funnel piece.
- Using forceps place 25 mm GFF filter on top of frit.

Sample collection:
- Use Nalgene bottle and wear gloves at all times.
- Collect, cap, and rinse bottle with sample water three times.
- Collect water just below the surface.
- Cap bottle.

Alana pouring 100ml of water sample through filter

Phosphates in the Field

- Blank Cell / Reference
- 45 mL of filtered sample water
- Reagent in a vacuumed ampule
- 2 minute minimum color development
- HACH colorimeter
  - PRGM 79
- Calculations
  - Hach reading in mg/L
  - Conversion to µg/L

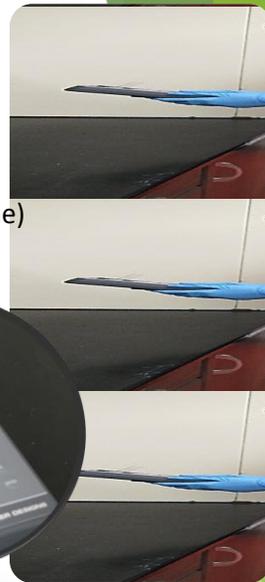*Shannon adds reagents to water sample while Bryce looks on*

Megan takes readings – 60 µg/L of phosphates at this site

Wet Lab Testing

Chlorophyll a

- Scintillation vial (protocol change – 90% acetone)
- Filter paper
- Glass cuvette
- AquaFlora fluorimeter
  - Simple reading
- Data Recording

  Field notebooks, Spreadsheet

Julie using the Aquaflora

Wet Lab Testing

Total Nitrogen (TN) (samples refrigerated 24 hours)

- • Reagents /centrifuged to precipitate out possible contaminates
- • Reagents cause small color change
- • Reference
- • HACH colorimeter measures
     minute change in color
- • 30-40 minute process
- Calculations
  - • Hach reading in mg/L
  - • Conversion to μg/L

 Note : MSA also "runs" other schools samples.
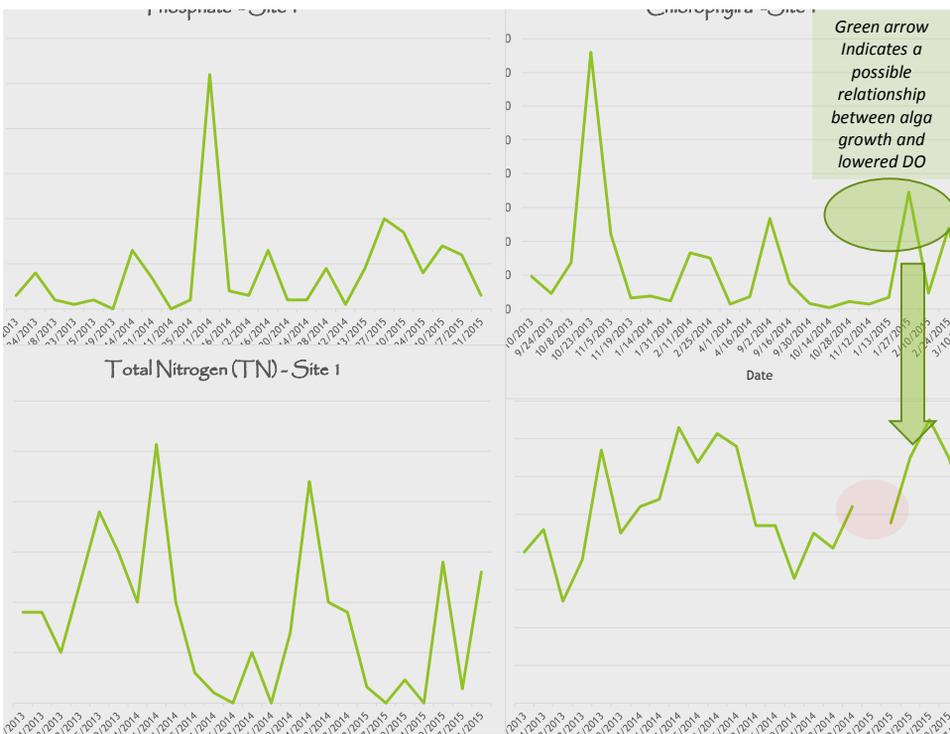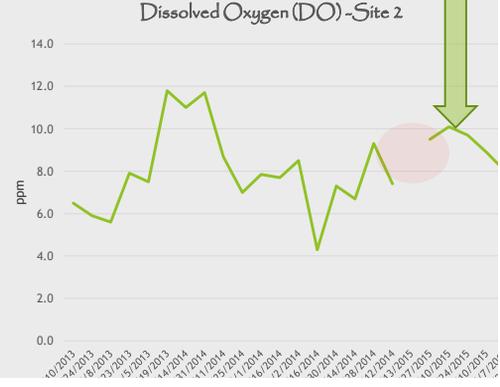

Sam, Bryce, and Michael of Manateam "run" TN

Data – 4 Sampling Sites 2014 - Present

Site 1
12th Ave

Site 2
Hyde Park
Rd

Site 4
Dog
Beach

Site 3
Boat
Launch

Team Ducks

Site 1
Carpenters Creek
meets Bayou Texar

Phosphate - Site 1

Chlorophyll a - Site 1

Green arrow Indicates a possible relationship between alga growth and lowered DO

Date

Total Nitrogen (TN) - Site 1

Site 2
Hyde Park Rd
11 15'03

Downhill path of runoff

Phosphate –Site 2

Chlorophyll a –Site 2

Total Nitrogen (TN) –Site 2

Dissolved Oxygen (DO) –Site 2

Site 3
Bayou Texar
Boat Launch

Site 4
Bayview Park
Dog Beach

Total Nitrogen (TN) - Site 4
Dissolved Oxygen (DO) - Site 4

Scatter Charts – Searching for Relationships
Site 4 (TN)

Analysis

Cultural Eutrophication:
High nutrients from pollution

⌄

Increased amount of chlorophyll a

⌄

Reduced dissolved oxygen

⌄

Dead Zone/Fish kill

What are considered high nutrients?
How are they dangerous?
Why do they matter?

Team Jellyfish

Nutrient Level (Trophic)Classifications
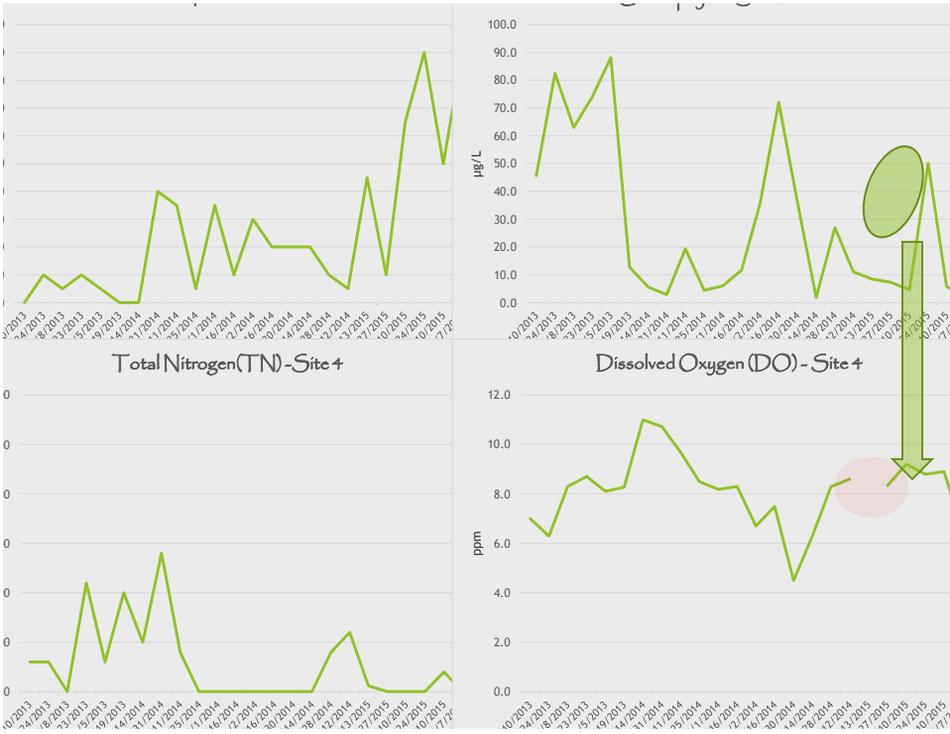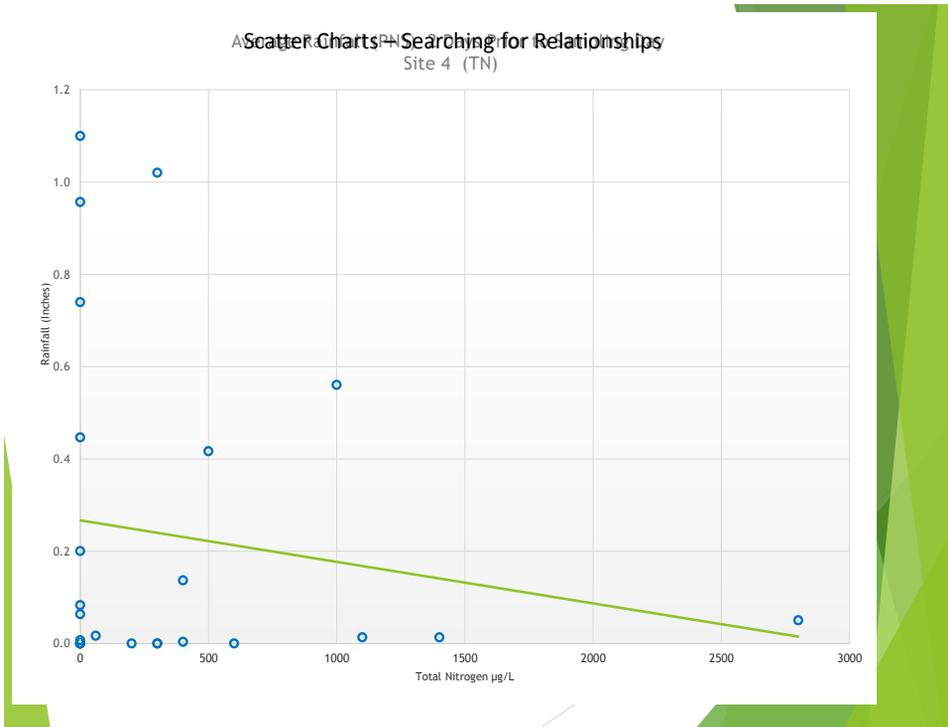
LAKEWATCH/IFAS

- **Oligotrophic** - often have very clear waters with high drinking-water quality. TI=<40

- **Mesotrophic** - intermediate level of productivity with beds of submerged aquatic plants . TI=40-50

- **Eutrophic** - has high biological productivity. TI=50-70

- **Hypereutrophic**- extremely high nutrient levels TI=70<

- The process of eutrophication can occur at various rates due to humans or naturally.

	Total Phosphates	Total Nitrogen (TN)	Chlorophyll a
Oligotrophic	< 12 µg/L	< 400 µg/L	< 2.6 µg/L
Mesotrophic	12-24 µg/L	400-600 µg/L	2.6-20 µg/L
Eutrophic	24-96 µg/L	600-1500 µg/L	20-56 µg/L
Hypereutrophic	96 < µg/L	1500 < µg/L	56 < µg/L

Total Nitrogen

- Site 2 is an area of concern seeing how the nitrogen levels are frequently eutrophic.
- Fall sampling – primarily mesotrophic levels
- In the past year it has had a extremely high TN level on one occasion (sediments disrupted)
- It continues to be area of concern.

Nitrogen testing in the wet lab

Total Nitrogen (TN) –Site 2
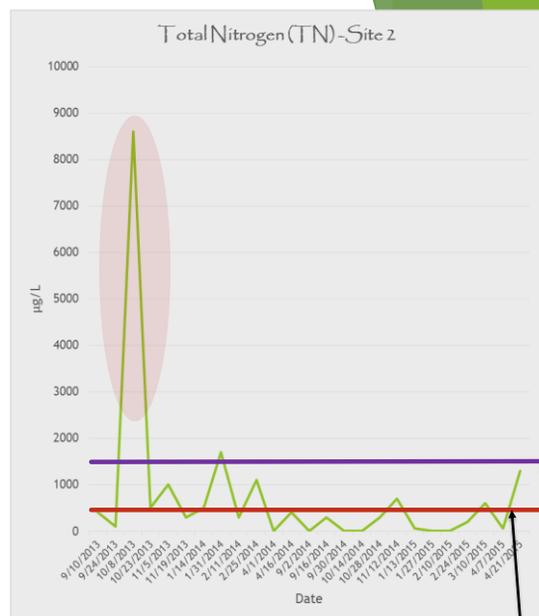
Above red line indicates eutrophic levels
Above purple line indicates hypereutrophic

Phosphates (P) and Chlorophyll a

► Phosphates levels are usually a limiting alga growth factor in aquatic ecosystem.

► Elevated phosphate may have caused chlorophyll a levels to climb over several weeks.

► High Chlorophyll a (alga blooms) typically follow times of elevated TN or P

► Site 2 still remains an area of interest for high nutrient levels however a t-test indicates no significant difference with site 4
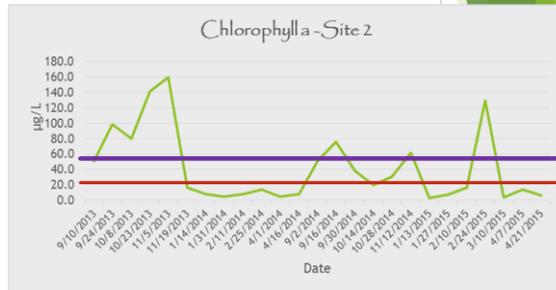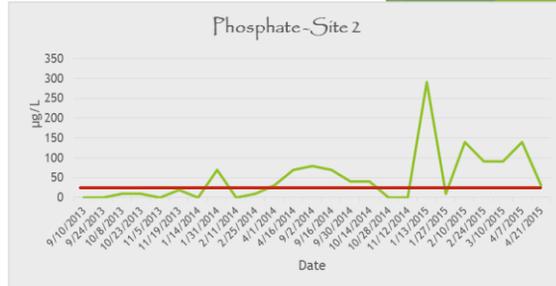
Above red line indicates eutrophic
Above the purple line indicates hypereutrophic

Reported Fish kills started 2nd week of September 2014

► Dissolved oxygen (DO) levels are affected by several factors - one such factor is chlorophyll a - as seen on 9/30/14.

► Dynamic processes can change hourly
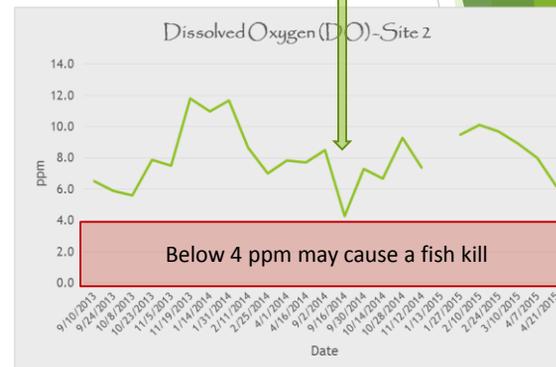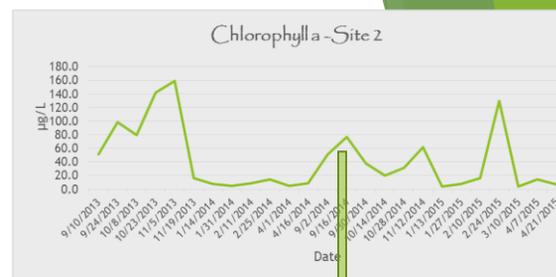
Below 4 ppm may cause a fish kill

Discussion

Manateam

Site 1: Carpenters Creek /Bayou Texar

▶ Data from Carpenters Creek has showed that DO is usually low, while Total Nitrogen and Phosphates are consistently higher than other sites and chlorophyll a is typically low (no evidence of an algal bloom).

Date	P (µg/L)	TN (µg/L)	DO (mg/L)	Chloro. a (µg/L)
9/2/2014	30	500	4.7	13.4
9/16/2014	130	0	4.7	3.8
9/30/2014	20	700	3.3	0.8
10/14/2014	20	2200	4.5	0.2
10/28/2014	90	1000	4.1	1.1
11/12/2014	10	900	5.2	0.7
1/13/2015	90	160	N/M	1.7
1/27/2015	200	0	4.8	17.3
2/10/2015	170	230	6.5	2.3
2/24/2015	80	0	7.5	11.9
3/10/2015	140	1400	6.5	0.9
4/7/2015	120	140	5.0	1.7
4/21/2015	30	1300	4.8	1.4

Why?

▶ Low DO- the area is a small body of water without much movement , surrounded by trees leading to no wind to create any wave movement (low fetch).

▶ High TN/P- may be attributed to runoff from Carpenters Creek and the now completed construction on and around the bridge.

Site 2: Hyde Park Road

▶ Has consistently high Chlorophyll a readings; could be caused by runoff or algae growing in the shallows among the grasses.

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> Grasses have a path that has been cut through them by the force of runoff from the road.

  > May be fixed by:

  - Installing some sort of buffer to break up the runoff's energy and slow it down .

  - Removing concrete slab and replacing with "Terracing catchment" or retention pond and use restoration plants such as emergent grasses /bushes to act as a natural buffer (phytoremediation) – "Living shoreline "

Site 4 Bayview Park

> Past hypothesis (2012): Dog beach will show signs of a "Nutrient hot spot "due to animal waste .
  - Hypothesis is not supported by data collected thus far, continued monitoring shows nutrient levels (TN and P) are consistent with our other two Bayou Texar sites at Hyde Park Road and the boat launch.

Possible Solutions
for high nutrient loads entering
Bayou Texar

Mitigation (offset damage from development)

▶ Living Shorelines

▶ Florida Friendly Yards

▶ Letter to request possible remediation at Hyde Park
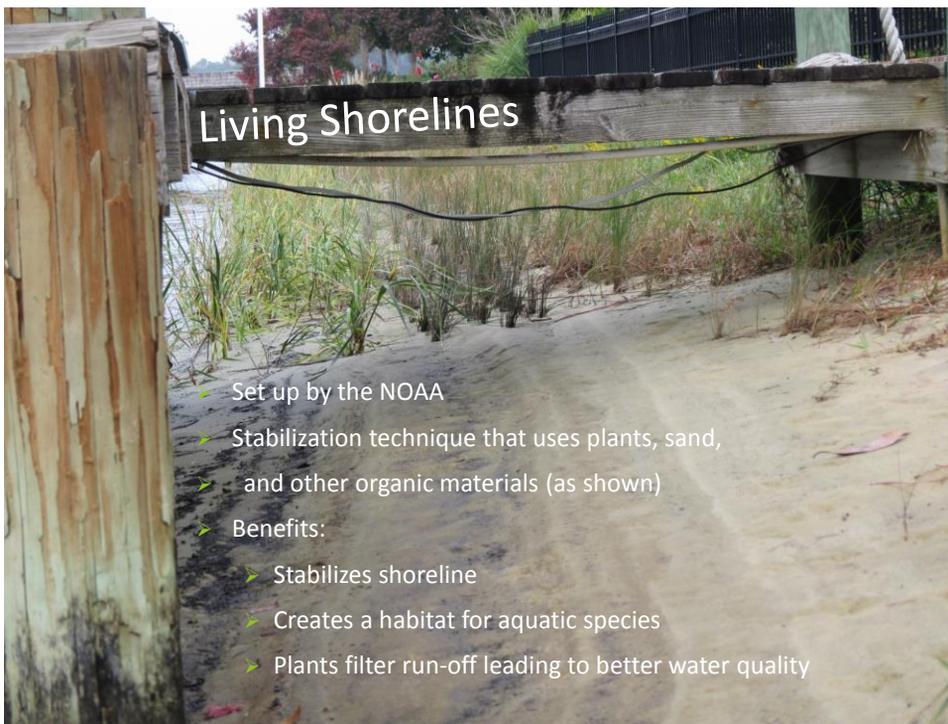
Living Shorelines

➢ Set up by the NOAA

➢ Stabilization technique that uses plants, sand,

  and other organic materials (as shown)

➢ Benefits:

  ➢ Stabilizes shoreline

  ➢ Creates a habitat for aquatic species

  ➢ Plants filter run-off leading to better water quality

Florida Friendly Yards

▶ Florida Friendly Yards is environmentally friendly landscaping alternative program for all homeowners not just water front owners

▶ Goals

▶ Become an asset to the environment

▶ Protect natural resources

▶ Preserve Florida's natural beauty

Florida Friendly Yard
FloridaYards.org
SolutionsForYourLife.com/fyn

Sources of Errors

▶ Secchi Reading inconsistencies
  - Different people distinguish black and white disk differently.
  - Different locations used at dog beach, other sites too shallow to measure – we should use a boat.

▶ Different citizen scientists teams doing each task on a rotational basis.
  - May cause inconsistencies in results/data

▶ Weather
  - Testing days are every second Tuesday, cannot plan around storms and rainfall/wind.

Chris using sampling pole 2014

Future Changes /Next Step

- ➢ Use Hach for turbidity measurements instead of Secchi disk.
- ➢ Continue testing through the summer months, to build a better model of Bayou Texars dynamics.
- ➢ Incorporate GIS imagery into the MSA website to make it more user friendly.
- ➢ Develop a multi level website for all local water quality information
- ➢ Challenge MSA Seniors to take an active role in community projects such as: DEP restoration project "Living Shore Line Plantings".
- ➢ Encourage MSA sophomores to continue promoting clean waterways through water assessment and public education.

Rachel showing a baffle box

Acknowledgements

- ➢ MSA Seniors (for providing a direction and excellent data to work with)
- ➢ MSA Underclassmen (For continuing ours and past MSA students work)
- ➢ The Gulf of Mexico Alliance and the
       National Oceanic and Atmospheric Association
- ➢ Dr. Matt Schwartz
- ➢ Dr. Allison Beauregard
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- ➢ MSA Director Mr. Edward Bauer
- ➢ Environmental Specialist Mr. Zach Schang
- ➢ Posner Marine
- ➢ Dr. Kim and Dr. Eric Lovell
- ➢ Biologist Ms. Barbara Albrecht
- ➢ Merchant Paper

Posner Marine

Questions ?

What would we consider perfect Bayou ?

- One which is safe to swim in, fish in, and free of man introduced pollutants.

- One that is respected by the surrounding population – they manage their yards with full knowledge that everything put in or on their yard could end up in the bayou.

- One that is free of harmful point and non point source pollution even after a rain event.

Presented By
MSA Honors Marine Biology II

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June Roberts

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Manateam

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