A Study of pH, Salinity, and Clarity of Water Samples from Various Locations Around the World

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Abstract- Water Quality content varies from community to community and from throughout the world. A number of variances are natural differences caused by nature and some are induced by human. The research team processed and compared the water quality results against the North Carolina Administrative Code, past CERSER research group results, local surrounding counties, statewide, countrywide and International water quality standards for samples from Austin Texas, Barcelona Spain, Pasquotank County, North Carolina, Indianapolis, Indiana & Lake Cavalier Portsmouth, Virginia.

Microsoft Excel which had statistical software capabilities within this package were used to display team results. (In order to illustrate these differences between Austin Texas, Barcelona Spain, Pasquotank County, North Carolina, Indianapolis, Indiana & Lake Cavalier Portsmouth, Virginia). The team examined and utilized LaMotte testing kits, then measured pH which displayed acidity. Salinity, Dissolved Oxygen, Alkalinity, Hardness, Nitrate, Conductivity, DIST WP was also tested.

The team utilized Google Earth for creating an aerial dataset utilizing KMZ scripting functionality. The team also linked and configured the Microsoft Excel Spreadsheet to communicate with Google Earth. The 2009 Water Quality Team developed the WSR Forms (Water sample request form) to record and maintain Water Quality data integrity.

I. INTRODUCTION

A. Overview

During the academic year of 2008 – 2009 the Water Quality team produced a vast array of data. In total we currently have forty-nine water samples and have tested five of those, for nitrate, alkalinity salinity, hardness, pH and DiST WP. We then took these parameters and directly correlated them to standards across the state, nation and internationally. Using this information we were able to conclude the quality of water for the five sample that where tested.

II. DIGITIZING PROCEDURES SAMPLES

A. Nitrate

Nitrate is a salt or ester of nitric acid, or any compound containing the univalent group –ONO2 or iNO3. Used in fertilizer, and when around 1000 ppm nitrate Nitrogen is considered poisonous. Although it is not usually considered a threat to freshwater fish, it is a plant nutrient and can harm marine invertebrates. We tested the nitrate using the Axial Reader Testing Procedures.
Fill the water sampling bottle (0688) with sample water.
Fill one test tube (0898) to the lower line (5 mL) with sample water.
Dilute to second line with ❋Mixed Acid Reagent (V-6278). Cap and mix.
Wait 2 minutes.
Use the 0.1 g spoon (0699) to add one level measure (avoid any excess) of ❋Nitrate Reducing Reagent (V-6279).
The mixing procedure is extremely important. Cap tube. Invert tube slowly and completely 30 times in 1 minute to insure complete mixing.
Wait 10 minutes.
Insert test tube into Axial Reader (2071). Fill two test tubes (0898) to the 10 mL line with sample water. Place in Axial Reader. Match sample
color to a color standard. Record as ppm Nitrate-Nitrogen.
NOTE: To convert to nitrate, multiply by 4.4. Record as ppm Nitrate.

B. Alkalinity

Alkalinity is a test for any of various bases, the hydroxides of the alkali metals and of ammonium, that neutralize acids to form salts and turn red litmus paper blue.
Fill the titration tube (0778) to the 5mL line with the sample water.
Add one BCG-MR Indicator Tablet(T-2311).
Cap and swirl to mix until tablet dissolves. Solution will turn blue-green.
Fill Direct Reading Titrator (0382) with ❋Alkalinity Titration Reagent B (4493).
Insert the Titrator into the center hole of the test tube cap.

While gently swirling the tube, slowly press the plunger to titrate until the solution color changes from blue-green to purple. Consult Alkalinity Endpoint Color Chart (4491-CC).

NOTE: If the plunger tip reaches the bottom line on the scale (200 ppm) before the endpoint color change occurs, refill the Titrator and continue the titration. When recording the test result, be sure to include the value of the original amount of reagent dispensed (200 ppm).

C. Salinity

Salinity is the measurement of or pertaining to a chemical salt, esp. of sodium, potassium, magnesium, etc., as used as a cathartic.

Fill test tube (0778) to 10 mL line with demineralized water from the Demineralizer Bottle (1151).

Fill the 0 - 1.0 Direct Reading Titrator (0376) to 0 line with sample water. Wipe any excess water off the Titrator. Dispense 0.5 mL of sample water into titration tube by depressing plunger until tip is at 0.5 line. Discard remaining water in Titrator.

Add 3 drops of ✳Salinity Indicator Reagent A (7460). Cap and gently swirl to mix. Solution will turn yellow.

Fill the 0-20 Direct Reading Titrator (0378) with ✳Salinity Titration Reagent B (7461DR). Insert Titrator into hole of cap..

While gently swirling sample, slowly depress the plunger until color changes from yellow to pink-brown. Read test result where the large ring on the Titrator meets the Titrator barrel. Record as ppt Salinity.

If Titrator becomes empty before color change occurs, refill and continue titrating. Add original amount (20 ppt) to final result.

NOTE: Each minor division = 0.4 ppt Salinity

D. Hardness

Hardness is the quality in water that is imparted by the presence of dissolved salts, esp. calcium sulfate or bicarbonate.

Fill a test tube (0608) to the 12.9 mL line with the sample water.

Add 5 drops of ✳Hardness Reagent #5 (4483). Swirl to mix.

Add one Hardness Reagent #6 Tablet (4484). Cap and swirl until tablet disintegrates. Solution will turn red.

Fill Direct Reading Titrator (0382) with Hardness Reagent #7 (4487DR).

Insert the Titrator into the center hole of the test tube cap

While gently swirling the tube, slowly press the plunger to titrate until the red color changes to clear blue.

Read the test result where the plunger meets the Titrator scale. Record as ppm Total Hardness as (CaCO3).

EXAMPLE: Test result is: Plunger tip is 2 minor divisions below line 80. 80 + (2 divisions x 4) = 88 ppm.

E. pH

pH is the symbol for the logarithm of the reciprocal of hydrogen ion concentration in gram atoms per liter, used to express the acidity or alkalinity of a solution on a scale of 0 to 14, where less than 7 represents acidity, 7 neutrality, and more than 7 alkalinity.

Remove the protective cap and turn the unit on.

Immerse pHep® 2 in the sample

Stir gently and wait until the display stabilizes.

After use, rinse the electrode with the water to minimize contamination

Store the electrode with a few drops of storage (HI 70300) or pH 7 (HI 7007) solution in the protective cap

Always replace the protective cap after use.

F. DiST WP 3

DiST WP 3 stands for Dissolved Solid Tester Water Proof, and is a type of conductivity tester.

Remove the protective cap

Turn the DiST WP on with the ON/OFF switch located on the top

Immerse into the sample without touching the bottom of the beaker.

Stir gently and wait until the display stabilizes. DiST WP compensates for the temperature automatically and variations on the display can be due to the temperature sensor adjusting to the new environment.

III. HARDWARE

A. HP Pavilion dv6000

Laptop manufactured by Hewlett Packard. Used to archive data and create it. The laptop was also used to view information from the internet.

B. LaMotte Nitrate Kit

Octa-Slide. Scale is 0.25, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0, 10.0 ppm (parts per million) Nitrate Nitrogen. The nitrate is reduced to nitrite by cadmium or zinc and this undergoes diazotization/coupling to form a pink color, the darker the color the more Nitrate in the solution.

C. LaMotte Alkalinity Kit

Alkalinity refers to the quantity and type of compounds present in the water that shift the pH above 7.0. Water with high alkalinity tends to be more strongly buffered. Buffering will reduce the tendency of the pH to shift. So we add sodium bicarbonate to increase alkalinity (buffering capacity) and calcium chloride for hardness, to see exactly when it changes.

D. LaMotte Salinity Tester

Salinity Tester used to find the level of salt in samples. Range is from very low readings (snowmelt) to ocean salinity levels (0-40 ppt salinity).

E. LaMotte Hardness Kit

The total hardness of water generally represents the total concentration of dissolved calcium and magnesium ions. Although closely related to alkalinity and the buffering capacity of water, high alkalinity may not always indicate high hardness. Hard waters (above 150 mg/l) are generally more productive for fish than soft waters. The typical range for aquaculture is 50 to 200 mg/liter.

F. Hanna Instruments Microprocessor pH Tester

This tester is to test the acidic or basic of a solution. The instrument sends a pulse into the solution, which then excites electrons and the tester the reads, the rate of return which will tell it the pH.

G. DiST WP

This tester measures the amount of dissolved solids in the water using electric currents that run from the tester into the solution. The temperature is not a factor because the tester automatically adjusts to the environment.

IV. Software

A. Photobucket

A content management system that allows to you store and edit up to one thousand pictures. We used this website to archive our photos.

B. Google Earth

A program that allows you to observe and mark any location on earth. We used this software to locate all our samples and catalog them into our database.

C. Microsoft Excel

A spreadsheet program from Microsoft, part of their Microsoft Office suite of productivity tools for Microsoft Windows and Macintosh. We used this program to create our spreadsheet.

D. Microsoft Word

Microsoft Word is a popular word processor that is part of the Microsoft Office suite. We used this software to create notes.

E. Microsoft PowerPoint

A component of the Microsoft Office suite,. PowerPoint creates different slides with a wide array of media which include video, still photos, animations, and lettering. We used this program to create our team presentation.

F. Adobe Dreamweaver

A web development application originally created by Macromedia, and is now developed by Adobe Systems. This program was used to create the team web page

G. Adobe Photoshop

A graphics editing program (also known as a DPD, Desktop Publishing Program) developed and published by Adobe Systems. This program was used to create graphics for our team web page.

V. Methods

A. Overview

The data of the water samples that the group collected from were based on two things: the information about the water samples and the data that the team collected from testing. For the various water samples that were collected outside of the group, there were bottles that were wrote on to tell us the information of where it was collected, when and what time was it collected, who got the sample, what kind of sample was it, and if there are photos that were taken for the water sample. The data for these aspects are located on new labels that the team made, recorded, and taped on the bottles to better preserve the data for the next water quality testing groups.

The reason for recording the data about the water is because the water may be affected by the different factors that the group has tested for. If one of the factors is affected because of the time, the place, or the day, it could mean that external factors are somewhat involved in determining the amounts of factors will be presented in the water that we've tested for.

The other data that was collected about the water sample was the actual experiment data that the group collected. The data was based on the tests of salinity, alkalinity, nitrate, pH, and DiST WP. The data that we've discovered was quite interesting because some of the factor that we've tested for didn't show up in the results. For each of the attempts that we've tested for the factors, some of the results were that there were none of the factors present in the water samples. This surprised the group for the reason that we continuously tested the water for extensive periods of time to make sure that the test results were proven to be true.

B. Data Table

To record this data, the team constructed a data table for what we tested, the trial number, the unit measured, who tested the sample, and who is currently recording the data. This way the team will be able to better keep up with the data according which water sample was tested and the results of the test.

The significance of recording what units that the water sample was tested in is because some of the components that we tested for was measured in ppt (parts per thousand) where as a lot of the tests had to measured in ppm (parts per million). If one of the components that were measured in ppt were mistakenly measured in ppm, the measurements would be off by quite a few decimal places causing a corruption of the data. For this matter, the person who is recording the data must place down their names in the bottom table of the log as the recorder so that if the tester has any questions about the data, they can refer back to the person who had recorded the data. Also, the data would be much more sufficient if there is someone there to critique the tester to make sure that the test is right. This would also benefit the tester in that they will not have to worry about testing and recording the data at the same time which could cause them to make a mistake in the experiment or the recording of the data.

C. Data Log Sheet

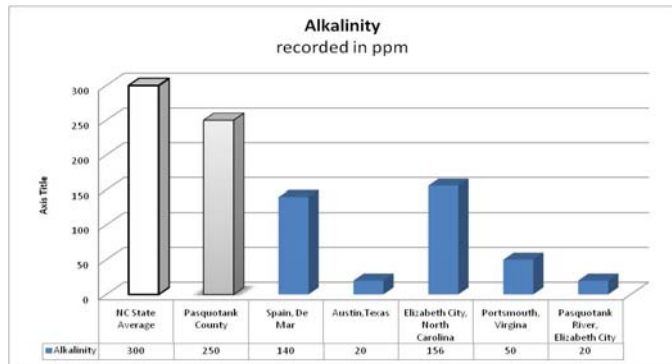The data log is also made with the date that it has been made so that future water quality testing teams will be aware as to making revisions to the log as time passes. This will be beneficial in adding more types of data that the team could test for and to make sure that all of the information that the future teams receive will be more up-to-date. Along with the date that the log has been revised,
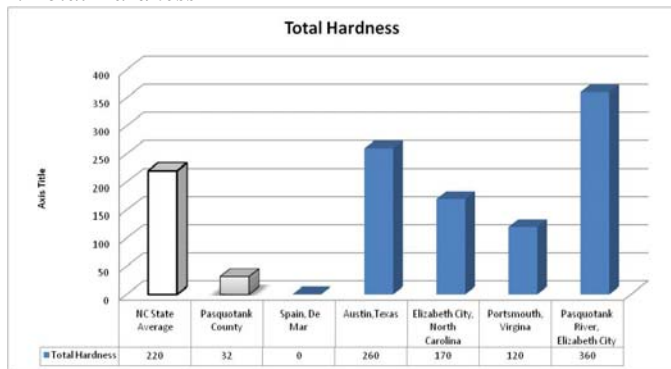
there is also the name of the person who has made the revisions so that if future changes must be made to the log, the team can go to that person to ask if they may make their own revisions to the log. Once the revisions have been made the files for the new revisions can be saved onto the team disk and stored away for future uses.
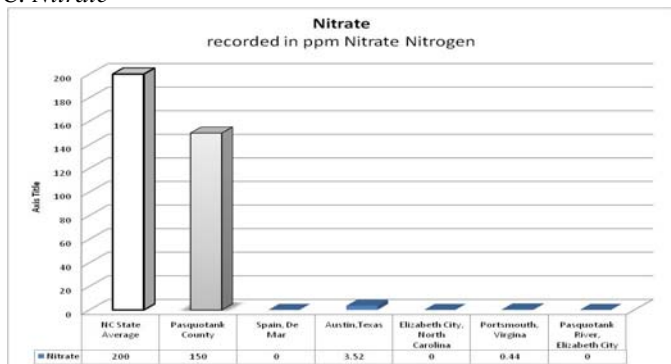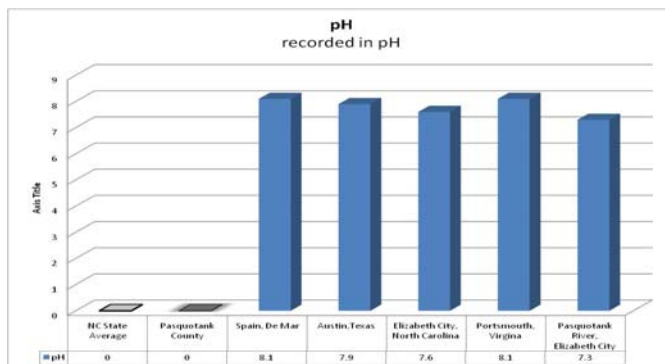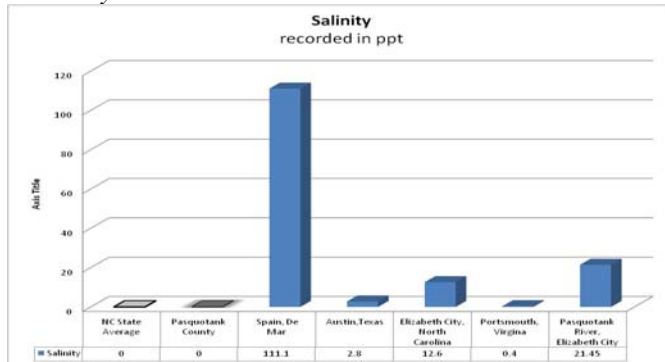
VI. RESULTS

A. Alkalinity

Alkalinity
recorded in ppm

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
Alkalinity	300	250	140	20	156	50	20

B. Total Hardness

Total Hardness

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
Total Hardness	220	32	0	260	170	120	360

C. Nitrate

Nitrate
recorded in ppm Nitrate Nitrogen

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
Nitrate	200	150	0	3.52	0	0.44	0

D. pH

pH
recorded in pH

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
pH	0	0	8.1	7.9	7.6	8.1	7.3

E. Salinity

Salinity
recorded in ppt

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
Salinity	0	0	111.1	2.8	12.6	0.4	21.45

F. DiST WP

DiST WP
recorded in µS/cm

	NC State Average	Pasquotank County	Spain, De Mar	Austin,Texas	Elizabeth City, North Carolina	Portsmouth, Virginia	Pasquotank River, Elizabeth City
DIST WP	0	0	598	1166	679	212	678

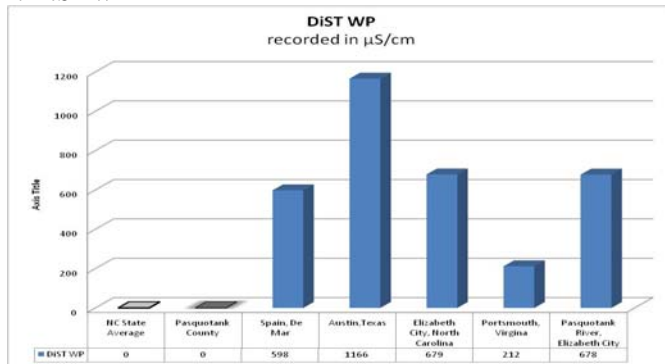## VII. FUTURE WORK

For our future work, there are four main things we would like to see happen. We would like the future group to, test more water samples, add to database to the created Database, collect More Water Samples, and invest in more Parameters

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[5]   http://www.epa.gov/acidrain/measure/ph.html