

A comparative study to the 2011/2013 water quality assessments in the Pasquotank Watershed in Northeastern North Carolina with a sea level rise component

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Abstract- The Pasquotank River Watershed is found in Northeast North Carolina beginning in the Great Dismal Swamp at the Virginia/North Carolina border and flows into the Albemarle Sound. The watershed provides a transition between spawning grounds and the waters of the Albemarle Sound. The sound serves as a nursery area for many fish species and is home to numerous sport and commercial species. Due to indications of rising global temperature and the monitoring of melting ice sheets, these coastal watersheds could be a leading indicator of rising sea levels as their chemical compositions changes. The effects of sea-level rise were also taken into consideration for future monitoring.

The 2014 Research Experience for Undergraduates Pasquotank River Watershed Team completed two sets of tests of five tributaries and the river itself. These test points were derived from the 2011 and 2013 Watershed Team research projects with the addition of four points created to sample further downstream in the Pasquotank River itself. Results were compared with previous readings utilizing a Water Quality Index (WQI). The streams tested were the Pasquotank River, Newbegun Creek, Knobbs Creek, Areneuse Creek, Mill Dam Creek, and Sawyers Creek. These streams, along with the river, cover a large portion of the watershed and provide a wide area of study for the watershed.

Tests performed in the laboratory on this year's samples included pH, salinity, total dissolved solids, and conductivity. Air/water temperature, dissolved oxygen, wind speed/direction, and turbidity/clarity measurements were taken in the field. The results collected were placed online and displayed in correlation to their position utilizing Google Maps. The data were then compared to the 2011 and 2013 project results and examined for any variations or similarities.

It was found that the water quality for some water sources remained in their respective ranges from the past years. The others, such as Knobbs Creek, varied from the previous years.

Newbegun Creek, with a water quality index of 59, stayed within the two previous teams' WQI of 50 (2011) and 66 (2013). Mill Dam Creek had a very slight increase in water quality but still managed to acquire a bad reading of 49. Areneuse Creek increased to reach a medium water quality of 57. The Pasquotank River, ranking as the lowest, has dropped significantly from 2011 to 2013 and continued to lower in 2014 standing a 41 for its WQI. Sawyers Creek remained consistent at a low medium range with this year's water quality being 51. The Knobbs Creek WQI, having the highest water quality reading, increased from the two past readings with a WQI of 63.

Keywords: water quality, Pasquotank, watershed, dissolved oxygen, pH, salt, conductivity, clarity, turbidity

I. INTRODUCTION

A. Overview

A watershed is a group of smaller bodies of water that flow into a larger body of water. The Targeted Local Watershed (TLW) for this year's research was the Pasquotank Watershed which included the Pasquotank River and several of its tributaries. The contributing waterways tested in this research were Knobbs Creek, Sawyers Creek, Areneuse Creek, Mill Dam Creek, and Newbegun Creek.

The 2014 Pasquotank Water Quality Team gathered the following data in order to evaluate the quality of the water: dissolved oxygen, turbidity, clarity, total dissolved solids (TDS), salinity, pH, and conductivity. Other items such as wind speed/direction, air/water temperature, latitude/longitude, and date/time were also recorded as factors that could influence the final analysis. This data was compared to the 2011 and 2013 summer research projects which targeted the same waterways.

An added component to this year's research was a focus on salinity as a result of sea level rise. As sea level rise occurs, coastal estuaries and ground water supplies are inundated with higher levels of salt affecting local plant and animal populations as well as residents living along the coast. Reduction in coastal forests has been documented in other areas of the United States. A drop in the number of species has also been recorded as their nesting and feeding areas undergo change. Testing points added in the lower Pasquotank River out to the mouth of the Newbegun Creek will allow for an increase monitoring of salinity levels in the Pasquotank Watershed. [1]

II. METHODOLOGY

A. Field Work

The canoe or boat was launched into the water and was loaded with the gear needed such as paddles, communication devices, test equipment, and data sheets. The test equipment was secured to the boat in case of an accident.

At each test point, several pieces of data were recorded. The time was noted as a reference for samples being taken as several test results could vary during the day. Once the time was taken, wind speed, wind direction, and air temperature were obtained. The water temperature and water sample were acquired utilizing the thermometer and bottle attached to a pole allowing them to be obtained at a consistent depth of three feet. The clarity and turbidity were acquired using the Secchi disk and the amount of dissolved oxygen in the water was obtained by using the DO meter. [2][3][4]

B. Post-Field Work

Once all the data was collected, in-house tests were performed to obtain the pH, conductivity, salinity and the total dissolved solids information. The pH meter was calibrated using distilled water and a pH tablet. The water samples that were taken from the field work were poured into small styrofoam cups for testing. The pH meter was placed into the sample and the pH readings were recorded. This was also done for the Pocket Tester which was used to test salinity, conductivity, and total dissolved solids. [5][6][7]

III. ANALYSIS

A. Water Quality Index

The overall water quality index (WQI) for all of the waterways that were tested remained constant. Individually, some have either fallen, some have risen, and the others remain in a range set by the past teams.

Newbegun Creek's water quality fell between the two water qualities recorded by the 2011 team and the 2013 team with a medium WQI. Mill Dam Creek's water quality has risen higher than both teams' readings but still has a bad WQI. Areneuse Creek's water quality is greater than the previous years and advanced to have a medium WQI. The Pasquotank River's water quality is lower than the 2013 and 2011 teams' readings and has the lowest reading for the 2014 Watershed Research Project. Sawyers Creek's water quality fell between the two previous teams' WQIs with a medium

water quality index. Knobbs Creek's water quality recorded a higher WQI than the two preceding teams and the highest for 2014. This year is the first year the lower Pasquotank has been tested.

IV. CONCLUSION

A. Variations

There were minor variations found in the WQI, but the overall quality of the waterways this year was within the medium range or close to it. The most noticeable variation was the comparison between the 2014, 2013, and 2011 TDS, salinity, and conductivity readings. The readings for 2014 decreased greatly from the 2013 and 2011 readings. This may have been due to the lower temperatures during this year's research period.

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