Long Term 03020103 Subbasin Assessment Results

Turbidity
Fecal Coliform Bacteria
Dissolved Oxygen
pH
Nutrient Enrichment

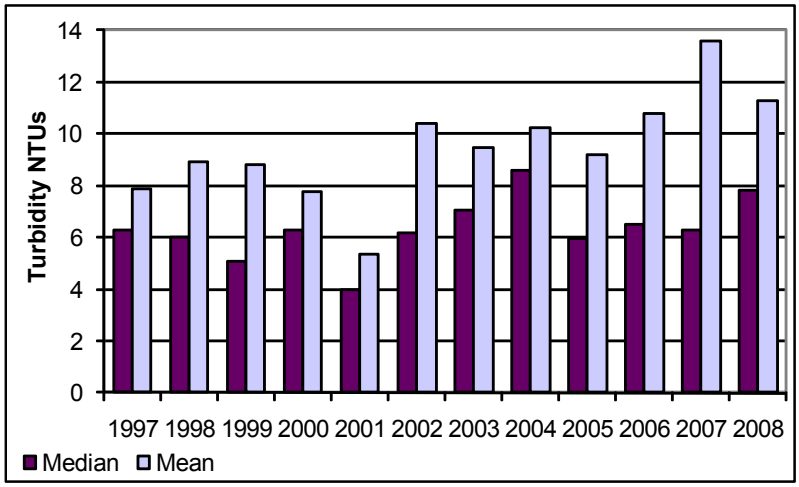
The following discussion of ambient monitoring parameters includes graphs showing the median and mean concentration values for all ambient stations (n=15) in this subbasin for a specific parameter over each year. These graphs are not intended to provide statistically significant trend information or loading numbers, but rather provide an idea of how changes in land use or climatic conditions effect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the dataset. Box and whisker plots of individual ambient stations were completed by parameter for data between 2002-2007 and can be found in the Ambient Monitoring report: http://portal.ncdenr.org/c/document_library/get_file?uuid=994c08a8-a98d-4ff5-9425-656cadf8cfa4&groupId=38364. Summary sheets for ambient data are found in Appendix 3C.

Turbidity

The turbidity standard for freshwater (Class C) streams is 50 NTUs. Currently, Ballahack Canal at SR 1526 near Conetoe (AU# 28-87-1.2) indicated turbidity as a stressor (3 out of 10 samples exceeded 50 NTUs) and is considered Impaired. One out of 10 samples in Flat Swamp at SR 1157 near Robersonville (AU# 28-103-2a) also exceeded turbidity standards.

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). It is important to note that the turbidity standard does not capture incident duration or the amount of sedimentation, both of which can impact aquatic species. Increasing turbidity levels is of special concern in

FIGURE 3-4. SUMMARIZED TURBIDITY VALUES FOR ALL DATA COLLECTED AT AMBIENT STATIONS IN HUC 03020103



this basin as phosphorous binds to sediment and is transported downstream and can contribute to nutrient enrichment conditions in the estuary.

Figure 3-4 shows data from 1,078 samples over the 12 year period, of which only 10 samples (1%) had results over 50 NTUs. Turbidity exceedances are likely a result of specific incidences (land use disturbance) and are not a subbasinwide issue.

Fecal Coliform Bacteria

The fecal coliform bacteria standard for freshwater streams is not to exceed the geomean of 200 colonies/100ml or 400 colonies/100ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are to be used to indicate whether the stream is Impaired or Supporting. Waters with a classification of B (primary recreation water) will receive priority for 5-in-30 studies. Other waterbodies will be studied as resources permit. Data through 2007 indicate several streams where bacteria colony numbers exceeded 400 colonies/100ml. Streams currently impacted by fecal coliform bacteria include:

Ballahack Canal (C, NSW) at SR 1526 near Conetoe (AU# 28-87-1.2)
Conetoe Creek (C, NSW) at SR 1409 near Bethel (AU# 28-87-(0.5)d)
Flat Swamp (C, Sw,NSW) near Robersonville (AU#s 28-103-2a & 28-103-2b)
Chicod Creek (C, NSW) at SR 1760 near Simpson (AU# 28-101)

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Figure 3-5. Summarized Fecal Coliform Bacteria numbers for all data collected at Ambient Stations in HUC 03020103

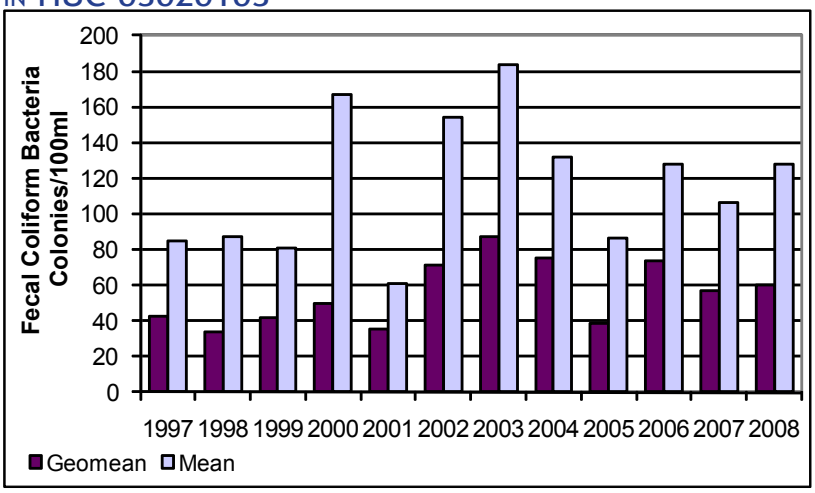


Figure 3-5 shows data from 1,081 samples over the 12 year period, of which 67 samples (6%) had fecal coliform bacteria levels above 400 colonies/100ml.

Dissolved Oxygen

The dissolved oxygen (DO) water quality standard for Class C waters is not less than a daily average of 5.0 mg/L with a minimum instantaneous value of not less than 4 mg/L, the latter standard being the most commonly used. Swamp waters may have lower values if the low DO level is caused by natural conditions. Dissolved oxygen can be produced by wind or wave action that mix air into the water or through aquatic plant photosynthesis. During the day, DO levels are higher when photosynthesis occurs and they drop at night when respiration occurs by aquatic organisms. High levels are found mostly in cool, swift moving waters and low levels are found in warm, slow moving waters. In slow moving waters, such as reservoirs or estuaries, depth is also a factor. Wind action and plants can cause these waters to have a higher dissolved oxygen

concentration near the surface, while biochemical reactions lower in the water column may result in concentration as low as zero at the bottom.

There are many sites in the basin that have low DO measurements. However, most of these sites were first sampled during the 2007 drought; the Tar Pamlico Basin Association sites began monitoring in March 2007. Nearly the entire monitoring history for these sites was during the 2007-08 drought, which, due to drops in flow, suppressed dissolved oxygen levels. Additional monitoring data during non-drought conditions will aid in identifying whether DO conditions are altered by anthropogenic pollutants.

Figure 3-6. Summarized Dissolved Oxygen Levels for all data collected at Ambient Stations in HUC 03020103

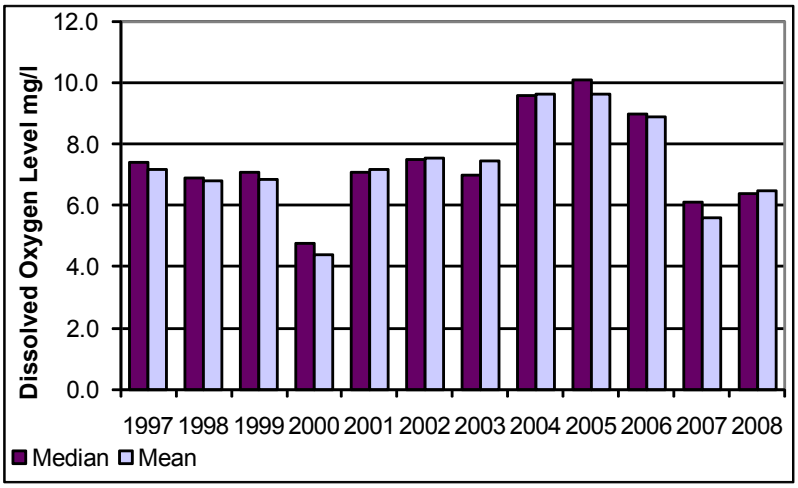


Figure 3-6 represents results from 769 samples collected over a 12 year period, of which 180 samples (23%) had instantaneous readings below 4 mg/L. A majority of the low DO levels occurred during the 2007-08 drought.

pH

The water quality standard for pH in surface freshwater is 6.0 to 9.0 standard units. Swamp water (supplemental Class Sw) may have a pH as low as 4.3 if it is the result of natural conditions. pH is a measure of hydrogen ion concentration that is used to express whether a solution is acidic or alkaline (basic). Values outside the 6.0-9.0 standard unit range can have chronic effects on the community structure of macroinvertebrates, fish and phytoplankton. The following waterbodies have experienced low pH levels at the sample sites.

Town Creek near Wiggins Crossroads (AU#28-83)
Ballahack Canal at SR 1526 near Conetoe (AU# 28-87-1.2)
Conetoe Creek at SR 1409 near Bethel (AU# 28-87-(0.5)d)

Figure 3-7. Summarized pH values for all data collected at Ambient Stations in huc 03020103

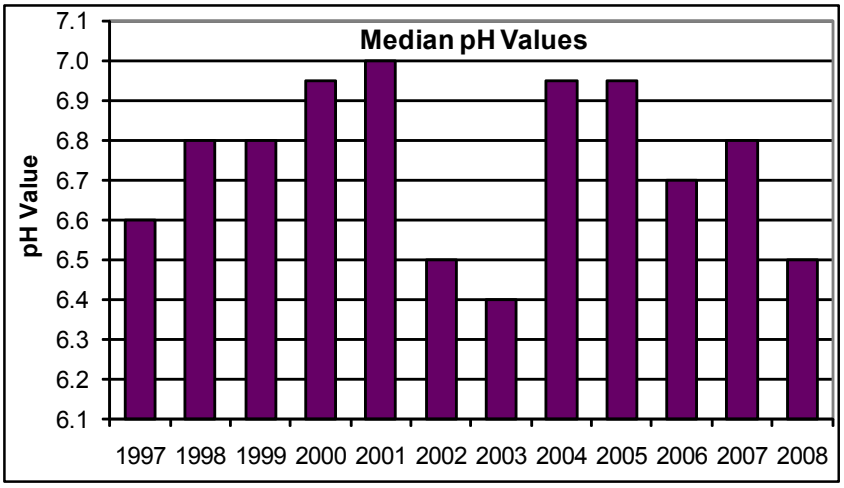


Figure 3-7 graph shows data from 1,329 samples over the 12 year period, of which only 113 samples (9%) had low pH readings.

Nutrient Enrichment

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as "nutrients". Nitrogen compounds include ammonia as nitrogen (NH_3), Total Kjeldahl Nitrogen (TKN), and nitrite+nitrate nitrogen (NO_2+NO_3). Total nitrogen (TN) is the sum of TKN and NO_2+NO_3. Phosphorus is measured as total phosphorus (TP) by DWQ. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes or runoff from urban or agricultural land, the growth of algae and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form ammonium hydroxide (NH_4OH), a form toxic to fish and other aquatic organisms.

Due to excessive levels of nutrients resulting in massive algal blooms and fish kills the entire Tar-Pamlico River Basin was designated as Nutrient Sensitive Water (NSW) in 1989. This designation resulted in the development and implementation of a nutrient management strategy to achieve a decrease in TN by 30% and no increase in TP loads compared to 1991 conditions. Even though implementation of the strategy has occurred by wastewater treatment dischargers, municipal stormwater programs, and agriculture, nutrient enrichment continues to be cumulatively impacting the Pamlico Estuary. A review of the NSW strategy, including implementation activities, progress towards meeting the loading goals and additional actions are discussed in Chapter 6.

Basin trend analyses were completed for nutrient concentration and daily loads to evaluate progress towards meeting TMDL reduction goals, as discussed in detail in the NSW Chapter 6. These analyses detected a statistically significant increase in TKN concentration and a decrease in NH_3 and NO_2+NO_3. There were no basinwide detected trends for TN or TP concentrations. TKN is defined as total organic nitrogen and NH_3. An increase in organic nitrogen is the likely source for the increase in TKN concentrations since NH_3 concentrations have decreased basinwide. Further analysis of these parameters were completed on a subbasin scale to determine whether concentrations changed over an 11 year time period. Currently, NC does not have nutrient standards; however, NC normal nutrient levels in class C waters are typically:

TP = < 0.05 mg/L
TN= < 0.8 mg/L
TKN= <0.5 mg/L
NH_3= < 0.05 mg/L

In early 2001, the DWQ Laboratory Section reviewed its internal Quality Assurance/Quality Control (QA/QC) programs and analytical methods. This effort resulted in a marked increase in reporting levels for certain parameters. New analytical equipment and methods were subsequently acquired to establish new lower reporting levels and more scientifically supportable quality assurance. As a result, the reporting levels quickly dropped back down to at or near the previous reporting levels. Nutrients were especially affected by these changes, as shown below:

	Reporting Level by Date (mg/L)			
Parameter	Pre-2001	3/13/2001 to 3/29/2001	3/30/2001 to 7/24/2001	7/25/2001 to present
NH_3	0.01	0.05	0.2	0.01
TKN	0.1	1.0	0.6	0.2
NO_2+NO_3	0.01	0.5	0.15	0.01
TP	0.01	0.5	0.1	0.02
Note: Do not let increased reporting levels be interpreted as a sudden upward trend. The DWQ Laboratory Section cautions that the establishment of minimum reporting levels may have been inconsistent and undocumented prior to those established in July 2001.				

Figure 3-8 represents data over a 12 year period, where 4,316 samples were taken, of which 4,079 (95%) samples had TP levels above 0.05 mg/L. These data and the estuarine algal response to nutrient loading indicates TP inputs to streams continues to be a problem.

For comparison, 1991 TP concentration data, shown in green: Median= 0.13 Mean = 0.11

Figure 3-8. Summarized Total Phosphorus values for all data collected at Ambient Stations in HUC 03020103

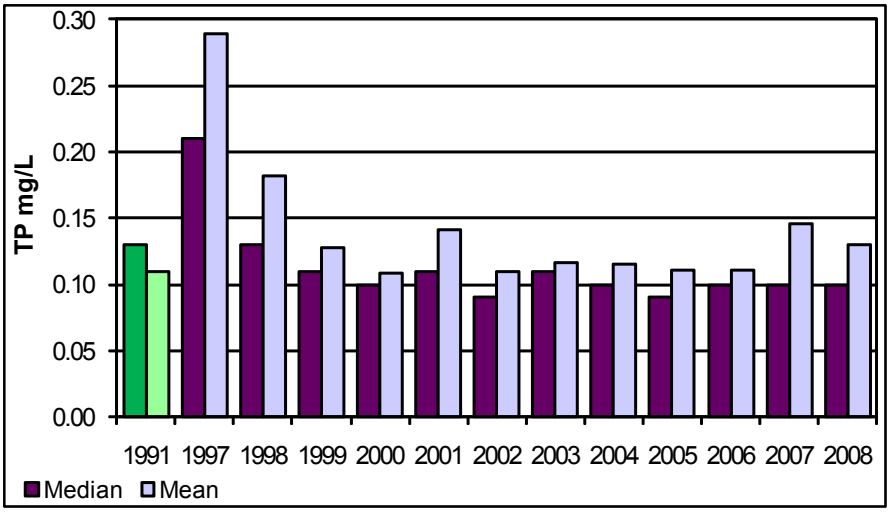


Figure 3-9. Summarized Total Nitrogen values for all data collected at Ambient Stations in HUC 03020103

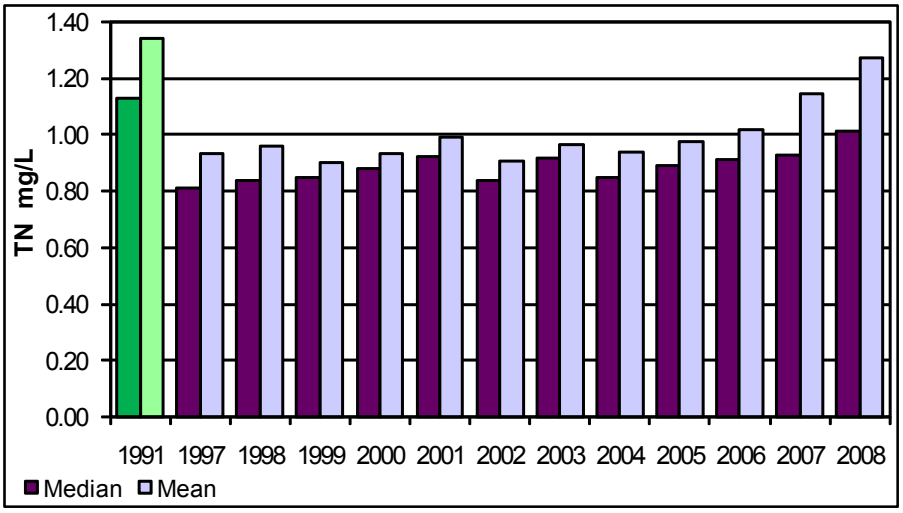


Figure 3-9 represents data from 4,307 samples collected over 12 years, of which 2,717 (63%) of them had TN levels above 0.8 mg/L. These data and the estuarine algal response to nutrient loading indicates TN inputs to streams continues to be a problem.

For comparison, 1991 TN concentration data, shown in green: Median= 1.13 Mean = 1.34

The noted basinwide TKN increase is also seen in TKN concentrations summarized for all stations within this subbasin (Figure 3-10). This subbasin is influenced by organic nitrogen inputs for HUCs 03020101 & 03020103.

For comparison, 1991 TKN concentration data, shown in green: Median= 0.45 Mean = 0.47

Figure 3-10. Summarized TKN concentration data for all stations in HUC 03020101