Appendix V-II

Algal bloom and press release information tables.

Table V-II.1. DWR Chowan River Basin Algal Bloom Assessment for Years 2015-2019.

Location	Date Sampled	Basin	Micro-cystin (ug/L) Toxin	Chl a µg/L	County	Cell Density + Cells/mL	Density + Units/mL	Biovolume + mm^3/m^3	Algal Group/ Dominant Taxa	Latitude	Longitude	Reason Reported	Station/Sample Code/ID Bloom ID & Notes
2015 Blooms:													
Chowan River Edenhouse D9490000	6/29/2015	Cho	ND	68	Chowan	T-83,000 C-79,00	T-6,500 C-2,600	T-5,000 C-4,300	CYA Anabaena planctonica	36.0476	-76.69611	Discolored water	CHO018/ Smplid10914-2015/ Bloom ID 2015027/AC20626
Chowan River West side nr Colerain	9/16/2015	Cho	ND	500	Bertie	T-2,738,000 C-2,738,000	T-3,800 C-3,100	T-82,000 C-82,000	CYA Microcystis	36.2001	-76.74994	Discolored Water	CRABWR91615/ 11112-2015 2015056/AC22649
2016 Blooms:													
Chowan River Indian Creek	7/20/2016	Cho	NA	NA	Chowan	T-12,000 C-12,000	T-2,500 C-2,400	T-800 C-800	CYA Anabaena	36.235	-76.67	Discolored Water	Indian Creek/11526-2016
Chowan River Between Arrowhead and Edenhouse	8/10/2016	Cho	ND	100	Chowan	T-139,000 C-138,000	T-5,400 C-4,400	T-15,000 C-14,000	CYA Anabaena	36.13868	-76.7294	Discolored Water	CRBR081016/ 11543-2016 2016036/AC31536
Chowan River Channel Marker 7 nr Colerain D8950000	9/7/2016	Cho	NA	NA	Chowan	NA	T-12,000	NA	CYA Microcystis	NA	NA	Discolored Water	According to USGS- Channel Marker 7 is near Colerain
2017 Blooms:													
Chowan River Edenhouse D9490000	6/12/2017	Cho	ND	ND	Chowan	T-80,000 C-56,000	T-4,500 C-2,700	T-7,000 C-5,500	CYA Dolichospermum	36.0476	-76.6961	Discolored Water	D9490000/CHO018/ 11953-2017 2017011/AC39626
Edenton Bay	6/12/2017	Cho	ND	160	Chowan	T-240,000 C-157,000	T-24,000 C-5,700	T-29,000 C-15,000	CRY Dolichospermum	36.06077	-76.6092	Discolored Water	EB61217/ 11952-2017/ 2017010 AC39625/EB061217
Chowan River Colerain D8950000	6/22/2017	Cho	ND	320	Bertie	T-561,000 C-560,000	T-18,000 C-17,000	T-54,000 C-54,000	CYA Dolichospermum	36.20983	-76.7268	Discolored Water	D8950000/CHO016/ 11987-2017 2017018/AC39209
Chowan River nr Rockyhock	7/10/2017	Cho	ND	ND	Chowan	T-162,000 C-161,000	T-13,000 C-12,000	T-14,000 C-14,000	CYA Dolichospermum	36.17994	-76.722	Discolored Water	CRRH071017/ 12012-2017 2017025/AC40697
Chowan River nr Whites Landing Rd.	10/16/2017	Cho	ND	24	Chowan	T-6,500 C-5,800	T-700 C-100	T-700 C-400	DIN Scrippsiella	36.16778	-76.7211	Foam	WLAB101617/12222-2017 AC43966
2018 Blooms:													
Chowan River Colerain D8950000	6/25/2018	Cho	ND	54	Chowan	T - 170,556 C -162,190	T- 9,900 C-7,100	T-7,400 C-6,700	CYA Dolichospermum, Polycystis	36.209830	-76.726770	Discolored Water	D8950000/CHO016 Bloom ID 2018023 AC51154/ D8950000_PHO

Location	Date Sampled	Basin	Micro-cystin (ug/L) Toxin	Chl a µg/L	County	Cell Density + Cells/mL	Density + Units/mL	Biovolume + mm^3/m^3	Algal Group/ Dominant Taxa	Latitude	Longitude	Reason Reported	Station/Sample Code/ID Bloom ID & Notes
Chowan River near Leary Landing	6/27/2018	Cho	0.44	5,400	Bertie	T-7,334,000 C-7,334,000	T-259,000 C-259,000	T-474,000 C-474,000	CYA Dolichospermum, Aphanizomenon	36.131761	-76.749140	Discolored Water	CRLL62718/CRAB062718 Bloom ID 2018024/AC52530 **Verified Chl a conc with Chem Lab ∓ – 5,400 µg/L**
Chowan River near Rockyhock	7/17/2018	Cho	0.72	28	Chowan	NA	NA	NA	NA	NA	NA	NA	No additional information available on this sample
Chowan River Johnson Point	7/19/2018	Cho	NA	NA	Chowan	T-27,000 C-22,000	T-3,600 C-1,800	T-2,100 C-650	CYA Dolichospermum	36.19954	-76.7181	Discolored Water	CRAB071818/12520-2018
Chowan River near Colerain D8950000	8/7/2018	Cho	1.40	120	Chowan	T-162,000 C-158,000	T-5,800 C-2,100	T-8,400 C-6,700	CYA Dolichospermum, Microcystis	36.209830	-76.726770	Discolored Water	D8950000/CHO016 Bloom ID 2018035 AC53266/ D8950000_PHO
Chowan River Edenhouse/Wharf Landing	8/7/2018	Cho	14.0*	ND	Chowan	T-918,000 C-913,000	T-25,000 C-20,000	T-61,000 C-60,000	CYA/ Dolichospermum, Microcystis	36.053500	-76.682020	Discolored Water	WLAB080718 Bloom ID 2018033 AC53686/Station: WARO_NLC. ***Note:*** Resampled 8/28/18 – CYA Biovolume dropped to 3,600; not listed in bloom datasheets.
Chowan River Edenhouse/Wharf Landing	8/27/2018	Cho	6.4	120	Chowan	T-118,000 C-114,000	T-4,700 C-2,300	T-4,500 C-3,600	CYA Pseudanabaena, Dolichospermum	36.05353	-76.682	Discolored Water	WLAB082818/ 12712-2018/AC54653
2019 Blooms:													
Chowan River near Harrellsville and Colerain	5/13/19	Cho	0.4^	610	Hertford	T-698,000 C-697,000	T-19,400 C-18,400	T-9,800 C-9,800	CYA/ Aphanizomenon	36.3220	-76.7376	Discolored water/Surface Scum	AC62831/WARO_NLC CRAB051319 Bloom ID 2019001 Some spreadsheets have it as 5/3/19 instead
Chowan River Edenton (Hwy 17) D94900NS	5/15/19	Cho	0.4^	10	Chowan	NA	NA	NA	NA	36.0536	-76.6841	NA	AC62842/D94900NS Not on Blooms 2019 list. Sampled for microcystin.
Chowan River Colerain (CM7) D8950000	5/29/19	Cho	0.4^	50	Chowan	T-66,000 C-59,000	T-4,800 C-1,600	T-4,800 C-2,900	CHL/Eudorina, Dolichospermum	36.2098	-76.7268	Discolored Water	AC62375/D8950000/CHO016 AC62376/D8950000_PHO
Chowan River near Harrellsville	6/5/19	Cho	NA	51	Hertford	T-101,000 C-96,000	T-4,100 C-2,100	T-6,400 C-4,700	CYA/Dolicho-spermum	36.3220	-76.7382	Discolored Water/ Green Flecks	CRHV0619 Bloom ID 2019007/AC63911 Data from 2019 algal bloom/fish kill table
Chowan River near Johnson Point	6/5/19	Cho	NA	ND	Chowan	T-48,000 C-41,000	T-6,500 C-3,600	T-3,100 C-1,000	CYA/Chroococcus, Dolichospermum	36.1990	-76.7157	Discolored water/ Bloom complaint	CRSF0619/AC63912 Data from 2019 algal bloom/fish kill table

Location	Date Sampled	Basin	Micro-cystin (ug/L) Toxin	Chl a µg/L	County	Cell Density + Cells/mL	Density + Units/mL	Biovolume + mm^3/m^3	Algal Group/ Dominant Taxa	Latitude	Longitude	Reason Reported	Station/Sample Code/ID Bloom ID & Notes
Chowan River Edenton (Hwy 17) D94900NS	6/12/19	Cho	0.4U	20	Bertie	NA	NA	NA	NA	36.0536	-76.6841	Discolored Water	AC63976/D94900NS Not on Blooms 2019 list. Sampled for microcystin.
Chowan River Edenton (Hwy 17) D94900NS	6/18/19	Cho	0.4U	94	Bertie	T-81,000 C-76,000	T-7,600 C-4,300	T-6,900 C-6,200	CYA/ Dolichospermum	36.0536	-76.6841	Discolored Water	AC64937/D94900NS Bloom ID 2019010
Chowan River Colerain D8950000	6/27/19	Cho	NA	57	Chowan	T-37,000 C-20,000	T-8,000 C-1,300	T-5,600 C-500	BAC/centrics	36.2098	-76.7268	Green Flecks/ Elevated DO & pH	D8950000/CHO016 Bloom ID 2019011 (Non HAB bloom) AMS monitoring date.
Chowan River Edenton (Hwy 17) D9490000	6/27/19	Cho	0.4U	58	Bertie	T-54,000 C-36,000	T-9,400 C-1,800	T-3,800 C-1,000	BAC/centrics	36.0470	-76.6970	Green Flecks/ Elevated DO & pH	AC63584/D9490000/CHO018
Chowan River Edenton (Hwy 17) D94900NS	7/17/19	Cho	0.4U	24	Bertie	NA	NA	NA	NA	36.0536	-76.6841	Not on bloom report spreadsheet	AC65470/D94900NS Included on Microcystin table
Chowan River near Arrowhead Beach Shawnee Trail Canal	7/17/19	Cho	310*	984	Chowan	T-853,000 C-852,000	T-7,900 C-7,200	T-32,000 C-31,000	CYA/ Microcystis	36.2246	-76.7069	Surface Scum/ Bluish White Scum	AC65469/WARO_NLC/ CRST71719 Bloom ID 2019021
Chowan River near Arrowhead Beach Shawnee Trail Canal	7/23/19	Cho	21*	72	Chowan	T-338,000 C-332,000	T-5,600 C-2,700	T-12,000 C-9,800	CYA/ Microcystis	36.2247	-76.7068	Discolored Water	AC65469/WARO_NLC/ STCR72319 Bloom ID 2019024
Chowan River at Leary Landing	7/29/19	Cho	190*	630	Bertie	T-9,097,000 C-9,093,000	T-9,600 C-6,797	T-280,000 C-273,000	CYA/ Microcystis	36.1386	-76.7515	Discolored Water/ Surface Scum with Clumps	AC66286/WARO_NLC/ESLL190729/LLCR72919 Bloom ID 2019025
Chowan River Colerain (CM7) D8950000	7/31/19	Cho	3.3	9	Chowan	NA	NA	NA	NA	36.2098	-76.7268	NA	AC64446/D8950000 Included on Microcystin table AC64447/D8950000_PHO
Chowan River Edenton (Hwy 17) D94900NS	8/13/19	Cho	0.4U	17	Bertie	NA	NA	NA	NA	36.0536	-76.6841	NA	AC66433/D94900NS Included on Microcystin table
Chowan River/Indian Creek (Dillard Cr.)	8/13/19	Cho	620*	ND	Chowan	T-18,596,000 C-18,570,000	T-13,4000 C-13,300	T-557,000 C-557,000	CYA/ Microcystis	36.2349	-76.6946	Discolored Water/ Surface Scum	AC66435/ESIC190813/ ICCR190813 Bloom ID 2019030

Location	Date Sampled	Basin	Micro-cystin (ug/L) Toxin	Chl a µg/L	County	Cell Density + Cells/mL	Density + Units/mL	Biovolume + mm^3/m^3	Algal Group/ Dominant Taxa	Latitude	Longitude	Reason Reported	Station/Sample Code/ID Bloom ID & Notes
Chowan River/Indian Creek (Dillard Cr.)	8/19/19	Cho	9.3	32	Chowan	T-235,000 C-231,000	T-2,600 C-400	T-7,900 C-6,900	CYA/ Microcystis	36.2327	-76.6950	Discolored Water	AC66641/WARO_NLC/ Dillard Creek Bloom ID 2019032
Chowan River Bess Landing	9/11 or 9/12/19	Cho	0.4U	18	Bertie	T-61,000 C-59,000	T-5,100 C-3,000	T-2,600 C-1,500	CYA/ Microcystis	36.1432	-76.7539	Discolored Water	AC67977/BLAB91219/ ESCR190911_2

* WHO (World Health Organization): Exceeds guideline of 10 ug/L indicating moderate probability of acute health effects from recreational exposure;
^ QA/QC issues;
+ T=Total Algae & C=Cyanobacteria/Bluegreen Algae;
Ŧ = April Williams, personal communication, May 18, 2020;
ND = Sheet was found, but no analytical data was found;
NA= Not available;
U = sample detection limit;
Q1 = sample holding time issue.

Table V-II.2. DWR and DHHS Press Release/Algal Bloom Recreational Advisories for the Chowan and Pasquotank River Basins (2015-2019).

Ref #	Date	Agency	Bloom Reported	Warning Provided	Chowan River /Albemarle Sound Bloom Locations Identified in Public New Release	Algal bloom species identified in the area	Microcystin Toxin Concentration (µg/L)
2015							
2015-1	July 23, 2015	DEQ	No specific date of bloom was provided in the notice.	Avoid contact with potentially harmful algal blooms; prevent children and pets from swimming or ingesting water.	Albemarle Sound and Chowan River near Queen Ann's Creek.	Cyanobacteria/ bluegreen algae; pHAB Anabaena planctonica	Sample sent to public health lab for microcystin testing.
2015-2	September 18, 2015	DEQ	No specific date of bloom was provided in the notice.	Avoid contact with toxic algal blooms/large accumulations of the algae; prevent children and pets from swimming or ingesting water.	In and around the Albemarle Sound; Chowan River. Blooms have turned up in waters in Bertie, Chowan, Herford, Perquimans and Washington Counties.	Cyanobacteria/ bluegreen algae; pHAB Microcystin aeruginosa	Sample sent to DHHS and toxin was identified. No concentration provided in the press release. (Colerain Chl a = 500 µg/L)
2016							
2016-1	July 22, 2016	DEQ	Since late June, 2016	Avoid contact with potentially harmful algal blooms; prevent children and pets from swimming or ingesting water.	Now concentrated in Edenton Bay, Chowan County.	Cyanobacteria/ bluegreen algae; pHAB Dolechospermum planctonicum	Indicates these are potential harmful blooms.
2016-2	September 9, 2016	DEQ	Blooms since June 2016; lingering	Avoid contact with green water/large accumulations of algae; prevent children and pets from swimming or ingesting water.	Chowan River from Colerain to Edenton Bay.	Cyanobacteria/ bluegreen algae; pHAB Microcystin and Anabaena	Indicates these are potential toxic blooms
2017							
2017-1	June 23, 2017	DEQ	Bloom since June 12, 2017	Avoid contact with green or blue water; prevent children and pets from swimming or ingesting water.	Chowan River, Arrowhead Beach area south to Edenton, beyond NC Hwy 32 bridge (this is in the Albemarle Sound).	Cyanobacteria/ bluegreen algae; pHAB Anabaena	No toxin assessment discussed.

Ref #	Date	Agency	Bloom Reported	Warning Provided	Chowan River /Albemarle Sound Bloom Locations Identified in Public New Release	Algal bloom species identified in the area	Microcystin Toxin Concentration µg/L
2018							
2018-1	July 3, 2018	DEQ	Bloom since June 20, 2018	Avoid contact with green or blue water; prevent children and pets from swimming or ingesting water.	Chowan River about 12 miles upstream of Edenton, however, can easily move to other areas.	Cyanobacteria/ bluegreen algae; pHAB Dolechospermum	6/27/18-Learly Landing = 0.44 µg/L
2018-2	August 8, 2018	DEQ	Bloom lingering since June 20, 2018	Avoid contact with green or blue water; prevent children and pets from swimming or ingesting water.	Bertie and Chowan Counties, with reports of the blooms along the eastern and western shorelines from Harrellsville downstream to Edenton Bay, including the Colerain and Rockyhock areas	Cyanobacteria/ bluegreen algae; pHABs Dolechospermum and microcystis	7/17/18 – Rockyhock = 0.72 µg/L; 8/7/18-Wharf Landing = 14 µg/L*; 8/7/18- Colerain = 1.4 µg/L
2019							
2019-1	June 11, 2019	DEQ	Bloom since May 14, 2019	Avoid contact with green or blue water; prevent children and pets from swimming or ingesting water.	Albemarle Sound and adjoining waterbodies (Perquimans River, Pasquotank River near Elizabeth City; western shore of the Chowan River. Currently affecting Bertie, Chowan, Pasquotank and Perquimans Counties.	Cyanobacteria/ bluegreen algae; pHAB Dolechospermum	No toxin identified in blooms, however there where QA/QC issues with the tests. No toxin samples collected on other dates.
2019-2	July 3, 2019	DEQ	Bloom since May 14, 2019	Avoid contact with green or blue water; prevent children and pets from swimming or ingesting water.	Albemarle Sound and adjoining waterbodies including the Chowan River; affecting Bertie and Chowan Counties.	Cyanobacteria/ bluegreen algae; pHAB Dolechospermum	Toxin was not detected above the PQL or not sampled. See photo of bloom on 7/2/19 in the Chowan (below).
2019-3	July 19, 2019	DHHS	Bloom since May, 2019	Avoid an algal bloom on the east side of Chowan River because of a toxin called Microcystin. Prevent children and pets from swimming or ingesting water.	Eastern side of Chowan River and Arrowhead Beach in Edenton	Cyanobacteria/ bluegreen algae; pHAB Microcyctis	Preliminary results 5-10 µg/L microcystin. Low level rick from recreational exposure.

Ref #	Date	Agency	Bloom Reported	Warning Provided	Chowan River /Albemarle Sound Bloom Locations Identified in Public New Release	Algal bloom species identified in the area	Microcystin Toxin Concentration µg/L
2019-4	July 23, 2019	DHHS	Numerous blooms since May 2019; report of specific bloom on July 17th.	Stay out of the Chowan River near Arrowhead Beach because of an algal bloom producing a toxin. Included a list of safeguards to take.	Chowan River near Arrowhead Beach	Cyanobacteria/ bluegreen algae; pHAB Microcyctis	Report indicated readings >250 µg/L (High risk); DWR lab reported concentrations: 7/17/19 – 310 µg/L* & 7/23/19 – 21 µg/L*
2019-5	August 5, 2919	DHHS	Numerous blooms since May 2019; report of specific bloom on July 29, 2019	Stay out of the Chowan River near Leary Landing because of an algal bloom producing a toxin. Included a list of safeguards to take.	Chowan River near Leary Landing and Arrowhead Beach	Cyanobacteria/ bluegreen algae; pHAB Microcyctis	7/29/19 - Leary Landing = 190 µg/L (high risk); 7/23/19 - Arrowhead Beach = 21 µg/L (high risk)
2019-6	August 16, 2019	DHHS	No date of bloom indicated in press release. Provided link to DWR interactive bloom map.	Stay out of the Chowan River near Indian Creek because of an algal bloom producing the highest levels of toxin recorded this year. Stay away from all blooms as they are more common in the late summer. Included a list of safeguards to take.	Chowan River near Indian Creek; Note: Blooms are more common during late summer due to war water temperatures and stagnant bodies of water. Because toxicity levels can change rapidly over time and location, it is best to stay away from all blooms whenever possible.	Cyanobacteria/ bluegreen algae; pHAB Microcyctis	8/13/19 - 620 µg/L* (Extremely high risk)
*WHO (World Health Organization): Exceeds guideline of 10 ug/L indicating moderate probability of acute health effects from recreational exposure.							

Links to DWR/DHHS Press Releases:

Future press releases here - https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/ecosystems-branch/algal-blooms

2015-2019 press releases -

2015-1: July 23, 2015 – https://deq.nc.gov/press-release/algal-blooms-fish-kills-occurring-across-portions-state

2015-2: September 18, 2015 – https://deq.nc.gov/press-release/people-urged-avoid-toxic-algal-blooms-eastern-north-carolina-waters

2016-1: July 22, 2016 - https://deq.nc.gov/press-release/people-urged-avoid-contact-algal-bloom-edenton-bay

2016-2: September 9, 2016 - https://deq.nc.gov/press-release/state-reminds-public-avoid-algal-blooms-chowan-river-area

2017-1: June 23, 2017 - https://deq.nc.gov/state-urges-public-avoid-algal-blooms-chowan-river-area

2018-1: July 3, 2018 – https://deq.nc.gov/news/press-releases/2018/07/03/public-urged-avoid-algal-blooms-chowan-river-area

2018-2: August 8, 2018 - https://deq.nc.gov/news/press-releases/2018/08/08/state-reminds-public-avoid-algal-blooms-chowan-river-area

2019-1: June 11, 2019 – https://deq.nc.gov/news/press-releases/2019/06/11/public-urged-avoid-algal-blooms-albemarle-sound-area

2019-2: July 3, 2019 – https://deq.nc.gov/news/press-releases/2019/07/03/public-still-urged-avoid-widespread-algal-blooms-albemarle-sound-area

2019-3: July 19, 2019 – https://deq.nc.gov/news/press-releases/2019/07/19/public-cautioned-avoid-toxin-producing-algal-bloom-chowan-river

2019-4: July 23, 2019 – https://www.ncdhhs.gov/news/press-releases/test-results-indicate-high-health-risk-contact-chowan-river-algal-bloom

2019-5: August 5, 2019 – https://www.ncdhhs.gov/news/press-releases/reported-algal-bloom-west-side-chowan-river

2019-6: August 16, 2019 – https://www.ncdhhs.gov/news/press-releases/test-results-show-highest-toxic-algae-levels-recorded-chowan-river-year

Dolichospermum bloom, Chowan River (7/2/18)

State of NC website links:

NC DWR Algal Blooms page with link to Interactive Algal Bloom Map - https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/ecosystems-branch/algal-blooms

NC DHHS – Cyanobacteria, Protecting Children & Dogs - https://epi.dph.ncdhhs.gov/oee/algae/protect.html

NC DHHS – Occupational & Environmental Epidemiology (Cyanobacteria) - https://epi.dph.ncdhhs.gov/oee/a_z/algae.html

Other Website links:

CDC – Harmful Algal Bloom (HAB)-Associated Illness - https://www.cdc.gov/habs/index.html

Website links for WHO cyanobacteria/microcystin information:

Guidelines for safe recreational water environments. Volume 1: Coastal and fresh waters (2003).

Full document: https://www.who.int/water_sanitation_health/publications/srwe1/en/

Chapter 8 (Algae and cyanobacteria in fresh water): https://www.who.int/water_sanitation_health/bathing/srwe1-chap8.pdf

EPA – WHO 1999 Guideline Values for Cyanobacteria in Freshwater - https://www.epa.gov/cyanohabs/world-health-organization-who-1999-guideline-values-cyanobacteria-freshwater

Table V-II.3. World Health Organization (WHO) 2003 Cyanobacteria/Microcystin Risk Table Summary from Guidelines for safe recreational water environments. Volume 1: Coastal and fresh waters (2003).

Relative Probability of Acute Health Effects	Cyanobacteria (cells/mL)	Microcystin (µg/L)	Chlorophyll-a (µg/L)
Low	< 20,000	<10	<10
Moderate	20,000-100,000	10-20	10-50
High	100,000-10,000,000	20-2,000	50-5,000
Very High	> 10,000,000	>2,000	>5,000