Appendix IV

DWQ Water Quality Monitoring Programs in the Cape Fear River Basin

DWQ Water Quality Monitoring Programs in the Cape Fear River Basin

Staff in the Environmental Sciences Branch (ESB) and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the Cape Fear River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Cape Fear River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

DWQ monitoring programs for the French Broad River Basin include:

- Benthic Macroinvertebrates
- Fish Assessments
- Aquatic Toxicity Monitoring
- Lake Assessment
- Ambient Monitoring System

Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs. A Biotic Index (BI) value gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont, coastal plain and swamp) within North Carolina, and bioclassifications fall into five categories: Excellent, Good, Good-Fair, Fair and Poor.

Overview of Benthic Macroinvertebrate Data

There were 273 benthic samples collected during this assessment period. The following table lists the total bioclassifications (by subbasin) for all benthos sites in the Cape Fear River basin. Benthos sampling may slightly overestimate the proportion of Fair, Poor and Severe stress sites, as DWQ special studies often have the greatest sampling intensity (number of sites/stream) in areas where it is believed that water quality problems exist. Many streams also ceased flowing during the summer drought of 2002. For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this appendix. Refer to *2003 Cape Fear River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html for more information on monitoring sites and for past benthic community ratings.

Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent rating for each site) in the Cape Fear River Basin

Subbasin	Excellent	Natural	Good	Moderate	Good-Fair	Not Impaired	Fair	Poor	Severe	Not Rated	Total
03-06-01					5		6			3	14
03-06-02			2		6		5	5		11	29
03-06-03					1		3	3			7
03-06-04			2		10	1	7			4	24
03-06-05					1		1			3	5
03-06-06	1		2		3		3	6		12	27
03-06-07	2		6		3	1	1	3		4	20
03-06-08					9		10				19
03-06-09	1		5		1		3	6			16
03-06-10	1		6		2		2	2		1	14
03-06-11										2	2
03-06-12			1		3		3			6	13
03-06-13					1						1
03-06-14	1		5		7	2				1	16
03-06-15			4		3		2			6	15
03-06-16				1	3					1	5
03-06-17		2		2	3					6	13
03-06-18										1	1
03-06-19	1		4		1					2	8
03-06-20				1							1
03-06-22		1		1	4		2	1	1	1	11
03-06-23		4	1	2				1	2	1	11
03-06-24				1							1
Total	7	7	38	8	66	4	48	27	3	65	273

Assessing Benthic Macroinvertebrate Communities in Small Streams

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring

information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

Fish Assessments

Historical studies of fish communities in the Cape Fear River basin were conducted primarily by the North Carolina Wildlife Resources Commission (NCWRC) in the 1960s and late 1970s. Several streams were sampled by DWQ during the past basinwide planning cycle (1994), and two samples were collected in 1999. Scores are assigned to these samples using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score.

During the late 1990s, application of the NCIBI has been restricted to wadeable streams that can be sampled by a crew of 2-4 persons using backpack electrofishers and following the DWQ Standard Operating Procedures (NCDEHNR, 1997). Work began in 1998 to develop a fish community boat sampling method that could be used in nonwadeable coastal plain streams. Plans are to sample 10-15 reference sites with the boat method once it is finalized. As with other biological monitoring programs, many years of reference site data will be needed before solid criteria can be developed to evaluate biological integrity of large streams and rivers using the fish community assessment.

Overview of Fish Community Data

Fish community samples have been collected at 85 sites in the Cape Fear River basin during this assessment period. The following table lists the most recent ratings since 1990, by subbasin, for all fish community sites. Refer to *2003 Cape Fear River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html for more information on monitoring sites and for past fish community ratings.

Summary of NCIBI Categories for All Freshwater Fish Community Sites (using the most recent rating for each site) in the Cape Fear River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
03-06-01		2	1		1		4
03-06-02		3	4	2	5		14
03-06-03	1	3	2	1			7
03-06-04	1	2			1		4
03-06-05			2				2
03-06-06		2	1	1			4
03-06-07	1	1	1			1	4
03-06-08		2	2	1			5
03-06-09	1	4					5
03-06-10	2	3	1	1		1	8
03-06-11				1			1
03-06-12			4	2			6
03-06-14						14	14
03-06-15						7	7
Total	6	22	18	9	7	23	85

Cape Fear River Basin Fish Kills

The NC DWQ has systematically monitored and reported on fish kill events across the state since 1996 (http://www.esb.enr.state.nc.us/). Investigators reported 43 incidents which killed more than one million fish in the basin from 1999 to 2003. All kills, except one, were reported from freshwaters and were generally evenly dispersed throughout the basin. Kills were attributed to low dissolved oxygen, algal blooms, temperature stress, and spills of toxic substances. The largest kill occurred as a result of bycatch from a fishing operation in the Atlantic Ocean off Yaupon Beach (Brunswick County) and involved an estimated one million menhaden. About one-half of the events investigated in the basin could not be attributed to an obvious cause.

Yearly kills reported decreased during the monitoring period from 14 events in 1999 to just three reports in 2003. The decrease has not been associated with any improvements in water quality throughout the basin.

Overview of Fish Tissue Sampling

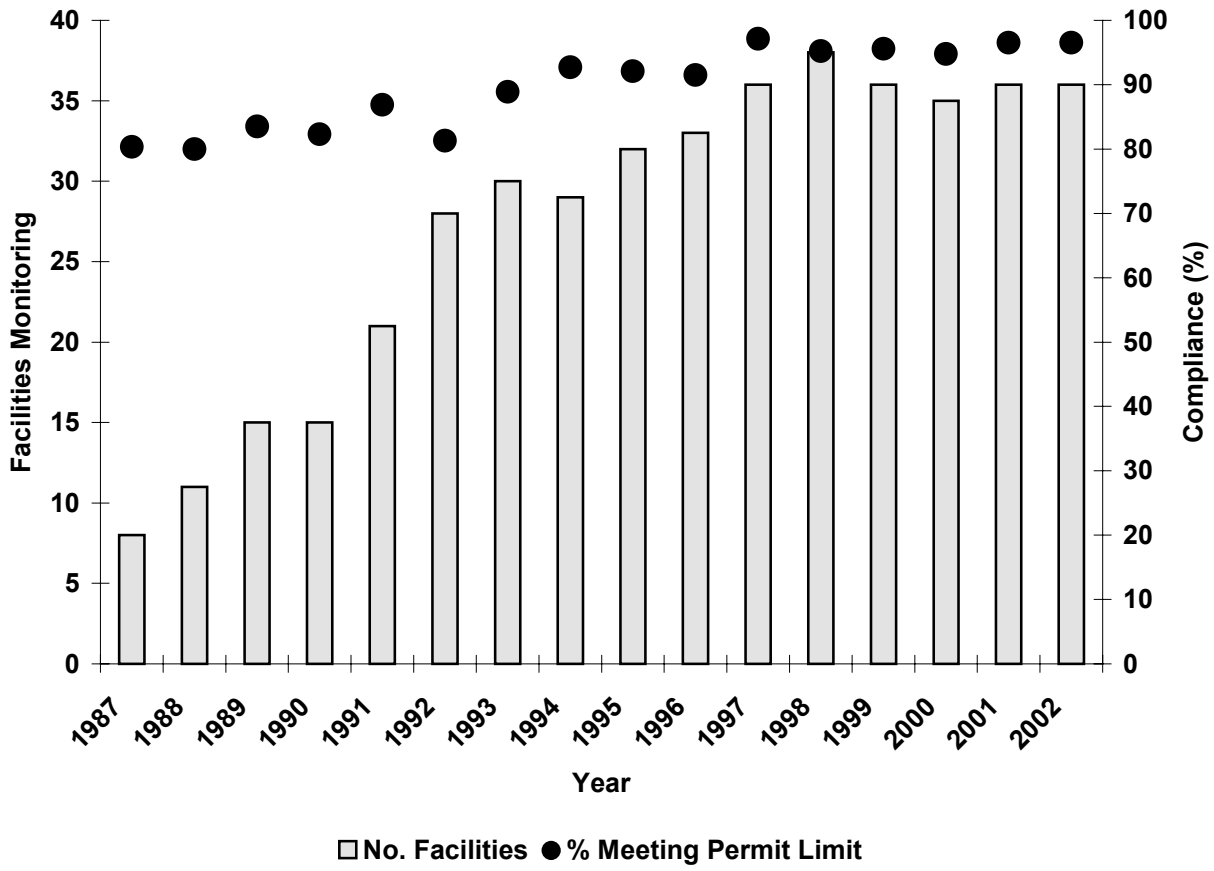
Fish tissue was sampled for metals contaminants at 12 stations within the basin from 1999 to 2003. All fish collected from the Coastal Plain in subbasins 03-06-16 to 03-06-23 were part of DWQ's eastern North Carolina mercury surveys. Three hundred-eight individual samples were analyzed. Total mercury concentrations exceeded the North Carolina criteria and USEPA's screening value (0.4 ppm) in 62 percent of the samples. Concentrations also exceeded the US Food and Drug Administration criteria limit of 1.0 ppm in 16 percent of the samples.

Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity (WET) by their NPDES permit or by administrative letter. Other facilities may also be tested by DWQ's Aquatic Toxicology Unit (ATU). Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

In addition, the ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

One hundred-nineteen facility permits in the basin currently require whole effluent toxicity (WET) monitoring. Ninety-four facility permits have a WET limit; the other 25 facility permits specify monitoring with no limit. Since 1999, the compliance rate for those facilities with a limit has stabilized at approximately 90 to 95 percent. Eleven facilities have had difficulty meeting their toxicity limits or targets and are discussed in the subbasin chapters.



Lakes Assessment Program

In 2003, 33 lakes in the basin were monitored as part of the Lakes Assessment Program. Each lake was sampled three times during the summer. Lakes with noted water quality impacts are discussed in the appropriate subbasin chapter.

Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collections of physical and chemical water quality data. North Carolina has more than 378 water chemistry monitoring stations statewide. Between 23 and 32 parameters are collected monthly at each station. The locations of these stations are listed in the following table and shown on individual subbasin maps. Chemical and physical measurements were obtained from 173 stations located throughout the basin by DWQ and three NPDES discharger monitoring coalitions. All data were collected between September 1, 1998 and August 31, 2003. Notable ambient water quality parameters are discussed in the subbasin chapters. Refer to *2003 Cape Fear River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html for more detailed analysis of ambient water quality monitoring data.

Subbasin	Station Number	Waterbody/Location Description	DWQ Index Number	Stream Classification
03-06-01				
	B0040000	Haw R. at SR 2109 near Oak Ridge	16-(1)	C NSW
	B0050000	Haw R. at US 29A near Benaja	16-(1)	C NSW
	B0160000	Little Troublesome Crk at SR 2600 near Reidsville	16-7	C NSW
	B0190000	Haw R. at NC 87 near Altamahaw	16-(1)	C NSW
	B0210000	Haw R. at SR 1561 near Altamahaw	16-(1)	C NSW
03-06-02				
	B0540000	N Buffalo Crk at SR 2832 near Greensboro	16-11-14-1	C NSW
	B0750000	S Buffalo Crk at SR 2821 at McLeansville	16-11-14-2	C NSW
	B0840000	Reedy Fork at NC 87 at Ossipee	16-11-(9)	C NSW
	B1095000	Jordan Crk at SR 1754 near Union Ridge	16-14-6-(0.5)	WS-II HQW
	B1140000	Haw R. at NC 49N at Haw River	16-(1)	C NSW
	B1260000	Town Branch at SR 2109 near Graham	16-17	C NSW
	B1960000	Alamance Crk at SR 2116 at Swepsonsville	16-19-(4.5)	C NSW
03-06-03				
	B1670000	Lake MacIntosh at NC 61 near Whitsett 19	16-19-3-(4.5)	WS-IV NSW
03-06-04				
	B1980000	Haw R. at SR 2171 at Saxapahaw	16-(1)	C NSW
	B2000000	Haw R. at SR 1005 near Saxapahaw	16-(1)	C NSW
	B2100000	Haw R. at SR 1713 near Bynum	16-(28.5)	WS-IV NSW
	B2450000	Robeson Crk at SR 1943 near Hanks Chapel	16-38-(3)	WS-IV NSW
	B4050000	Haw R. below Jordan Dam near Moncure	16-(42)	WS-IV
03-06-05				
	B3025000	Third Fork Crk at NC 54 near Durham	16-41-1-12-(2)	WS-IV NSW
	B3040000	New Hope Crk at SR 1107 near Blands	16-41-1-(11.5)	WS-IV NSW
	B3660000	Northeast Crk at SR 1100 near Nelson	16-41-1-17-(0.7)	WS-IV NSW
03-06-06				
	B3900000	Morgan Crk at SR 1726 near Farrington	16-41-2-(5.5)	WS-IV NSW
03-06-07				
	B6160000	Cape Fear R. at NC 42 near Corinth	18-(4.5)	WS-IV CA
	B6370000	Cape Fear R. at US 401 at Lillington	18-(16.7)	WS-IV
03-06-08				
	B4210000	W Fork Deep R. at SR 1818 near High Point	17-3-(0.7)	WS-IV CA
	B4240000	E Fork Deep R. at SR 1541 near High Point	17-2-(0.3)	WS-IV
	B4410000	Richland Crk at SR 1145 near High Point	17-7-(4)	WS-IV CA
	B4440000	Deep R. at SR 1129 near High Point	17-(4)	WS-IV CA
	B4615000	Deep R. at SR 1921 near Randleman	17-(4)	WS-IV CA
03-06-09				
	B4800000	Deep R. at SR 2122 at Worthville	17-(10.5)	C
	B4890000	Haskett Crk at SR 2128 near Central Falls	17-12	C
	B5070000	Deep R. at SR 2615 at Ramseur	17-(10.5)	C
	B5131000	Deep R. at NC 42 near Coleridge	17-(10.5)	C
	B5190000	Deep R. at SR 1456 near High Falls	17-(10.5)	C
03-06-10				
	B5480000	Bear Crk at NC 705 at Robbins	17-26-(6)	C
	B5520000	Deep R. at NC 22 at High Falls	17-(25.7)	C HQW
	B5575000	Deep R. at NC 42 at Carbonton	17-(32.5)	WS-IV
03-06-11				
	B5820000	Deep R. at US 15 and 501 near Sanford	17-(38.7)	C
	B6040300	Deep R. at SR 1011 old US 1 near Moncure	17-(43.5)	WS-IV
	B6050000	Deep R. at CSX RR Bridge near Moncure	17-(43.5)	WS-IV
03-06-12				
	B6000000	Rocky R. at NC 902 near Pittsboro	17-43-(8)	C
03-06-13				
	B6830000	Upper Little R. at SR 2021 near Lillington	18-20-(24.5)	WS-IV
	B6840000	Cape Fear R. at NC 217 at Erwin	18-(20.7)	WS-V
03-06-14				
	B7245000	Lower Little R. at SR 2023 near Lobelia	18-23-(10.7)	WS-III HQW
	B7280000	Lower Little R. at SR 1451 at Manchester	18-23-(24)	C

Subbasin	Station Number	Waterbody/Location Description	DWQ Index Number	Stream Classification
03-06-15				
	B7600000	Cape Fear R. at NC 24 at Fayetteville	18-(26)	C
	B7610000	Cape Fear R. at Riverside Landing	18-(26)	C
	B7700000	Rockfish Crk at SR 1432 near Raeford	18-31-(18)	B
	B8220000	Rockfish Crk near US 301 Hope Mills	18-31-(23)	C
	B8224000	Rockfish Crk at SR 2350 near Cedar Creek	18-31-(23)	C
03-06-16				
	B8300000	Cape Fear R. at Wo Huske Lock near Tar Heel	18-(26)	C
	B8305000	Cape Fear R. at SR 1316 at Tarheel	18-(26)	C
	B8321000	Turnbull Crk at SR 1509 near Johnsontown	18-46	C
	B8340000	Cape Fear R. at Lock 2 near Elizabethtown	18-(26)	C
	B8340050	Browns Crk at NC 87 mouth	18-45	C
	B8350000	Cape Fear R. at Lock 1 near Kelly	18-(59)	WS-IV Sw
	B8360000	Cape Fear R. at NC 11 near Kings Bluff	18-(59)	WS-IV Sw
03-06-17				
	B8445000	Livingston Crk at mouth near Riegelwood	18-64	C Sw
	B8450000	Cape Fear R. at Neils Eddy Landing near Acme	18-(63)	C Sw
	B9020000	Cape Fear R. DNS Hale Pt Landing near Phoenix	18-(63)	C Sw
	B9050000	Cape Fear R. at Navassa	18-(71)	SC
	B9740000	Northeast Cape Fear R. at US 421 at Wilmington	18-74-(61)	SC Sw
	B9800000	Cape Fear R. at CM 61 at Wilmington	18-(71)	SC
	B9820000	Cape Fear R. at CM 56 near Wilmington	18-(71)	SC
03-06-18				
	B8919000	South R. at SR 1503 near Parkersburg	18-68-12-(8.5)	C Sw ORW +
03-06-19				
	B8490000	Little Coharie Crk at SR 1414 Minnie Hall Rd near Salemburg	18-68-1-17	C Sw
	B8545000	Little Coharie Crk at SR 1240 near Roseboro	18-68-1-17	C Sw
	B8580000	Great Coharie Crk at SR 1311 near Clinton	18-68-1	C Sw
	B8679500	Six Runs Crk at SR 1919 near Moltonville	18-68-2-(0.3)	C Sw
	B8725000	Six Runs Crk at SR 1960 near Taylors Bridge	18-68-2-(11.5)	C Sw ORW +
	B8750000	Black R. at NC 411 near Tomahawk	18-68	C Sw ORW +
03-06-20				
	B9013000	Black R. at Raccoon Island near Huggins	18-68	C Sw ORW +
03-06-21				
	B9080000	Northeast Cape Fear R. at SR 1937 near Mt Olive	18-74-(1)	C Sw
	B9090000	Northeast Cape Fear R. at NC 403 near Williams	18-74-(1)	C Sw
03-06-22				
	B9190500	Goshen Swamp at SR 1004 near Westbrook Crossroad	18-74-19	C Sw
	B9196000	Northeast Cape Fear R. at SR 1961 at Hallsville	18-74-(1)	C Sw
	B9470000	Rockfish Crk at I-40 at Wallace	18-74-29	C Sw
03-06-23				
	B9480000	Northeast Cape Fear R. at SR 1318 near Watha	18-74-(29.5)	C Sw
	B9490000	Angola Crk at NC 53	18-74-33-3	C Sw
	B9520000	Burgaw Canal at US 117	18-74-39	C Sw
	B9550000	Lillington Crk at SR 1520 near Stag Park	18-74-42	C Sw
	B9580000	Northeast Cape Fear R. at US 117 at Castle Hayne	18-74-(47.5)	B Sw
03-16-24				
	B9865000	ICW at Morris Landing	18-87	SA ORW
	B9872000	ICW at CM 102 near Long Point	18-87-11.7	SA ORW
	B9872500	ICW at CM 123 near Howe Point	18-87-11.7	SA ORW
	B9874000	ICW at US 74 and 76 at Wrightsville Beach	18-87-24	SB
	B9876000	ICW at CM 151 near Everett N	18-87-25.7	SA ORW
	B9879000	Carolina Beach Harbor at CM 7	18-87-31.2	SB