

Appendix II

Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**

Benthic Macroinvertebrate Sampling Methodology and Bioclassification Criteria

Benthic macroinvertebrates can be collected using two sampling procedures. DWQ's standard qualitative sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs. The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens), Common (3-9 specimens) or Abundant (≥ 10 specimens).

Several data analysis summaries (metrics) can be produced from standard qualitative samples to detect water quality problems. These metrics are based on the idea that unimpaired streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings are also based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI). Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions.

Water quality ratings assigned with the biotic index numbers are combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for mountain/piedmont/coastal plain streams. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality. If the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value is used to determine the final site rating.

Benthic macroinvertebrates can also be collected using the DWQ's EPT sampling procedure. Four composite samples are taken at each site instead of the 10 taken for the qualitative sample: 1 kick, 1 sweep, 1 leafpack and visual collections. Only intolerant EPT groups are collected and identified, and only EPT criteria are used to assign a bioclassification.

The expected EPT taxa richness values are lower in small high quality mountain streams, <4 meters in width or with a drainage area <3.5 square miles. For these small mountain streams, an adjustment to the EPT taxa richness values is made prior to applying taxa richness criteria. Both EPT taxa richness and biotic index values also can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling (June-September). For samples collected in other seasons, EPT taxa richness can be adjusted. The biotic index values can also be seasonally adjusted for samples collected outside the summer season.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

Swamp Streams

Extensive evaluation, conducted by DWQ, of swamp streams across eastern North Carolina suggests that different criteria should be used to assess the condition of water quality in these systems. Swamp streams are characterized by slower flow, lower dissolved oxygen, lower pH, and sometimes very complex, braided channels and dark-colored water. DWQ has developed draft biological criteria that may be used in the future to assign bioclassification ratings to these streams. However, DWQ believes that there has been insufficient sampling of reference swamp streams to assign these ratings and use them for aquatic life use support determinations in the White Oak River basin at this time.

Draft swamp stream rating criteria evaluate swamp streams based on benthic macroinvertebrate data (collected in winter), fish community data and a habitat score. Benthic data collected outside of the winter high flow period are not used to assign ratings. At least two of the above-referenced data types must be collected in order to assign a rating. Each of these data types is assigned a point value of 10 (Good), 5 (Fair) or 1 (Poor), and the points are averaged to assign an overall site rating (OSR): Good-Excellent (>7.5), Fair-Good (5.0-7.5), Fair (2.0-4.9) and Poor (<2.0). Ratings for the benthic macroinvertebrate communities are based entirely on the biotic index value: Good <6.99, Fair 7.75-7.00, Poor >7.75. Deep (nonwadeable) coastal rivers with little or no visible current have different EPT criteria that are being used on a provisional basis until more data can be gathered.

Estuarine Waters

Circulation patterns, salinity and substrate variability make estuarine areas more dynamic than freshwater streams. DWQ has developed and tested biological criteria for estuarine waters with salinities greater than 8-10 ppt. These criteria, based on DWQ's freshwater criteria, use three metrics, Total Taxa Richness, Intolerant Taxa Richness (Amphipods and Caridean Shrimp) and a Biotic Index (EBI) to assign one of five water quality classes (Impact levels). One to five points are assigned to the value of each of the three metrics at a site, then summed to give a site score of 3-15 points. Proposed criteria for estuaries are: No Impact (13-15 points), Slight Impact (11-12 points), Moderate Impact (8-10 points), Elevated Impact (6-7 points), and Heavy Impact (3-5 points). Eaton (2001) demonstrates that this method is robust over time, salinity and substrate types over an area of several miles. DWQ has not adopted these criteria, so they cannot be used for aquatic use and life support determinations.

For estuarine areas with salinities below 8 ppt, the Estuarine Biotic Index (EBI) appears to be the only metric that can reliably separate Impacted from Reference sites. While no rigorous studies have been performed for these areas and no draft criteria proposed, it appears that sites with EBI values above 2.1 are usually unimpacted, while sites with EBI values less than that are usually suffering some sort of stress.

Flow Measurement

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. However, some between-year changes in the macroinvertebrate community may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low

flow years may accentuate the effects of point source dischargers by providing less dilution of wastes.

For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140% of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60% of the long-term mean, while normal flow is 60-140% of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state, and large variation within a single summer period.

Habitat Evaluation

DWQ has developed a habitat assessment form to better evaluate the physical habitat of a stream. The habitat score has a potential range of 1-100, based on evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed for assigning ratings indicating Excellent, Good, Fair or Poor habitat.

Table A-II-1 Benthic Macroinvertebrate Data Collected in the White Oak River Basin, 1983 – 1999
(Current basinwide monitoring sites have the map number bolded.)

Subbasin/ Site	Location	County	Map No.	Index No.	Date	S/EPTS (S/A & C/S) ¹	BIBIEPT (E/B/I) ¹	Bio Class/ Final score ¹
03-05-01								
Freshwater								
White Oak R	US 17	Jones	B-2	20-(1)	7/99	70/15	7.07/6.16	G-F
					2/99	61/11	7.11/5.83	NR
White Oak R	Haywoods Landing	Jones	B-3	20-(1)	8/94	36/4	8.77/4.31	F
					6/86	49/5	7.87/5.83	F
					7/84	58/8	7.80/7.04	G-F
Starkeys Cr	SR 1434	Onsbw	B-11	20-10	2/99	93/15	7.28/5.66	NR-22
Holston Cr	NC 58	Jones	B-12	20-12	11/99	-13	-4.99	NR
					2/99	58/17	6.26/4.44	NR-30
					3/98	50/15	5.85/4.92	NR-30
Hunters Cr	SR 1100	Carteret	B-13	20-17	2/99	56/11	6.80/6.04	NR-28
Webb Cr	SR 1432	Onsbw	B-14	20-19	2/99	30/3	7.34/4.06	NR-10
Pettiford Cr	USFS Rd	Carteret	B-15	20-29-1	2/99	38/10	6.38/4.71	NR-30
					3/98	30/8	6.39/5.45	NR-30
Estuarine								
Queen Cr	Atm outh	Onsbw	B-1	19-41-16	8/94	103/17	2.26	NR-11
White Oak R	Holland Pt	Onsbw	B-4	20-(14.5)	2/96	32/2	1.72	NR-8
White Oak R	Cahoon Pt	Onsbw	B-5	20-(14.5)	2/96	65/9	1.65	NR-11
White Oak R	Robinson Pt	Onsbw	B-6	20-(14.5)	2/96	69/8	1.98	NR-8
White Oak R	North of Jones Isl	Onsbw	B-7	20-(14.5)	2/96	88/15	2.40	NR-10
White Oak R	Above Swansboro	Carteret	B-8	20-(18)	9/94	65/12	2.03	NR-9
White Oak R	Near Swansboro	Carteret	B-9	20-(18)	6/99	145/26	2.66	NR-15
					2/96	111/16	2.23	NR-11
White Oak R	Near Huggins Isl	Onsbw	B-10	20-(18)	2/96	137/23	2.48	NR-13
Fosters Cr	Off outfall	Onsbw	B-16	20-35	8/94	64/14	2.68	NR-12
03-05-02								
Freshwater								
New R	NC 24	Onsbw	B-1	19-(1)	7/95	-10	-5.90	F
New R	SR 1314	Onsbw	B-2	19-(1)	7/99	53/11	6.40/6.08	G-F
					7/95	74/12	6.63/6.05	G-F
					8/94	52/3	7.18/5.27	NR
					6/90	70/15	6.43/5.13	G-F
					7/88	88/24	6.04/4.19	G
					6/86	84/24	6.16/4.97	G
					7/85	96/24	6.19/4.61	G
					7/84	92/25	6.19/4.76	G
					7/83	83/20	6.32/5.28	G-F
Blue Cr	Above Blue Cr Utility	Onsbw	B-15	19-8	2/97	40/6	6.89/5.76	F
Blue Cr	Bebw Blue Cr Utility	Onsbw	B-16	19-8	2/97	53/7	7.57/5.40	F
Northeast Cr	SR 1434	Onsbw	B-17	19-16-(0.5)	2/99	62/10	6.97/5.20	NR-22
L Northeast Cr	SR 1423	Onsbw	B-18	19-16-2	2/99	62/15	6.60/5.48	NR-30
Harris Cr	SR 1109	Onsbw	B-19	19-17-3	2/99	63/13	7.13/5.70	NR-26
Southwest Cr	SR 1213	Onsbw	B-20	19-17-(0.5)	2/99	69/11	7.54/5.98	NR-22
Southwest Cr	SR 1105	Onsbw	B-21	19-17-(6.5)	8/94	59/5	7.04/6.57	F
Wallace Cr	Above NC 24	Onsbw	B-22	19-20	5/95	37/2	7.70/5.67	NR
UT Wallace Cr	Bebw Phet Green	Onsbw	B-23	19-20	5/95	15/0	9.16/-	NR
NW Mill Cr	Upstream NC 210	Onsbw	B-24	19-39-3-1	8/85	58/5	7.49/5.18	NR
					2/84	43/5	7.11/5.98	NR
NW Mill Cr	Downstream NC 210	Onsbw	B-25	19-39-3-1	8/85	44/2	7.57/3.22	NR
					2/84	22/3	6.35/5.93	NR
NE Mill Cr	Near confluence	Onsbw	B-26	19-39-3-1	8/85	49/1	7.81/6.37	NR
N Mill Cr	Near confluence	Onsbw	B-27	19-39-3-1	8/85	26/2	7.40/5.84	NR
E Mill Cr	Bebw confluence	Onsbw	B-28	19-39-3-1	8/85	34/0	7/83/-	NR
					2/84	36/2	7.50/3.53	NR
Estuarine								
New R	Near Ethridge Pt	Onsbw	B-3	19-(11)	8/94	11/-	1.0*	NR
Brinson Cr	Atm outh	Onsbw	B-4	19-(12)	8/94	7/-	1.0*	NR
Wilson Bay	At outfall	Onsbw	B-5	19-(14)	6/99	15/1	1.67	NR
					5/97	2/0	1.00	NR
					6/96	2/0	1.00	NR

Subbasin/ Site	Location	County	Map No.	Index No.	Date	S/EPTS (S/A & C S) ¹	BIBIEPT (E BI) ¹	Bio Class/ Final score ¹
Wilson Bay	Offpoint	Onsbw	B-6	19-(14)	6/99	9/0	1.70	NR
					5/97	9/0	1.12	NR
					6/96	4/0	1.00	NR
					8/94	2/-	1.0*	NR
Wilson Bay	In center	Onsbw	B-7	19-(14)	6/99	10/2	1.34	NR
					5/97	5/0	1.02	NR
					6/96	4/0	1.00	NR
Wilson Bay	South side	Onsbw	B-8	19-(14)	6/99	9/2	1.16	NR
					5/97	14/1	1.38	NR
					6/96	11/0	1.35	NR
New R	OffSpring Pt		B-9	19-(15.5)	6/99	34/7	1.77	NR-7
					5/97	26/6	1.54	NR-9
					6/96	26/5	1.98	NR-9
					8/94	19/1	2.47	NR-8
New R	NearHadnotW W TP	Onsbw	B-10	19-(15.5)	6/99	35/8	1.73	NR-6
					5/97	25/5	1.93	NR-8
					6/96	30/5	2.11	NR-9
					8/94	21/1	2.12	NR-6
New R	Stones Bay W W TP	Onsbw	B-11	19-(15.5)	6/96	22/3	1.88	NR-6
New R	Stones Bay	Onsbw	B-12	19-(15.5)	6/96	23/2	1.76	NR-6
New R	NearCourthouse Bay	Onsbw	B-13	19-(15.5)	6/96	65/12	2.47	NR-7
New R	NearHallPt	Onsbw	B-14	19-(15.5)	6/96	76/15	2.29	NR-8
New R (C W)	NearSneads Feny	Onsbw	B-29	19-41-(0.5)	7/99	141/29	2.71	NR-15
					11/96	103/16	2.35	NR-11
					6/96	161/26	2.66	NR-15
					8/94	153/29	2.48	NR-13
					6/93	92/19	2.50	NR-14
					6/90	81/17	2.63	NR
					6/89	71/12	2.22	NR
					7/88	66/13	2.60	NR
					6/87	67/11	2.59	NR
					6/86	65/13	2.64	NR
					7/85	70/10	2.36	NR
					7/83	37/4	2.37	NR
					03-05-03			
Freshwater								
NW PrNewportR	SR 1206	Carteret	B-2	21-2	2/99	40/6	6.53/3.34	NR-26
SW PrNewportR	Fire Service Rd,	Carteret	B-3	21-3	3/98	16/2	6.82/6.27	NR-26
SW PrNewportR	SR 1124	Carteret	B-4	21-3	2/99	38/10	6.54/4.66	NR-26
NewportR	US-70	Carteret	B-5	21-(1)	7/83	24/2	7.82/5.70	NR
Estuarine								
Bogue Sound	NearEmerald Isle	Carteret	B-1	20-36-(0.5)	6/99	112/23	2.72	NR-15
					11/96	116/21	2.80	NR-15
					11/96	132/26	2.82	NR-15
					11/96	116/22	2.81	NR-15
					9/94	131/27	2.80	NR-15
					6/94	125/26	2.72	NR-15
					6/91	121/22	2.61	NR-15
					6/90	95/19	2.59	NR
					6/89	97/15	2.59	NR
					6/88	80/14	2.60	NR
					6/87	67/9	2.75	NR
					6/86	81/14	2.72	NR
					7/85	82/12	2.71	NR
					7/84	67/9	2.62	NR
					7/83	59/10	2.74	NR
NewportR	NearCrab Pt	Carteret	B-6	21-(17)	6/99	129/20	2.33	NR-12
					8/94	102/12	2.42	NR-10
					6/91	94/15	2.14	NR
					6/90	48/9	2.22	NR
					6/88	76/12	2.46	NR
					7/87	67/10	2.29	NR
					6/86	52/6	2.17	NR
					7/85	44/6	2.22	NR

Subbasin/ Site	Location	County	Map No.	Index No.	Date	S/EPTS (S/A & C S) ¹	BIEPT (E BI) ¹	Bio Class/ Final score ¹
Morehead Harbor	SW of Radcliffe Is	Carteret	B-7	21-(17)	7/99	161/33	2.86	NR-15
					8/94	105/22	2.62	NR-15
					6/94	132/31	2.97	NR-15
					6/91	116/30	2.72	NR
					6/90	77/18	2.44	NR
					6/88	111/16	2.47	NR
					6/86	72/12	2.70	NR
					7/85	73/10	2.73	NR
					6/94	32/10	3.48	NR-10
Beaufort Inlet	Ft Macon Jetty	Carteret	B-8	21-(17)	6/94	32/10	3.48	NR-10
Wills Cr	at point	Carteret	B-9	21-29	7/99	105/14	2.16	NR-11
Calico Cr	Piggotts Br	Carteret	B-10	21-32	7/99	37/6	1.69	NR-3
					8/94	22/2	1.76	NR-3
Calico Cr	at mouth	Carteret	B-11	21-32	7/99	53/4	1.91	NR-4
Taylors Cr	Rachel Carson Re	Carteret	B-12	21-34	6/88	65/10	2.23	NR
03-05-04								
Taylors Cr	W of Beaufort WWTP	Carteret	B-1	21-34	9/94	19/0	2.9*	NR
Taylors Cr	E of Beaufort WWTP	Carteret	B-2	21-34	9/94	11/1	3.4*	NR
North R	US-70	Carteret	B-3	21-35-1	8/94	55/6	2.27	NR-7
North R	At mouth	Carteret	B-4	21-35-1	8/94	99/25	2.84	NR-15
Ward Cr	US 70	Carteret	B-5	21-35-1-7	8/94	35/6	2.10	NR-6
					7/85	40/9	2.32	NR
Back Sound	Marker 3	Carteret	B-6	21-35-(1.5)	8/94	118/22	2.59	NR-15
Nelson Bay	Marker 1	Carteret	B-7	21-35-7-10- (5)	8/94	77/20	2.84	NR-12
					8/94	87/26	2.95	NR-13
Janett Bay	Midden Pt	Carteret	B-8	21-35-7-22	8/94	87/26	2.95	NR-13
03-05-05								
Back Sound	Marker 30	Carteret	B-1	21-35-(1.5)	8/94	100/26	2.90	NR-15
Core Sound	Goose Isl	Carteret	B-2	21-35-7	8/94	105/22	2.83	NR-15
Core Sound	Marker 25	Carteret	B-3	21-35-7	8/94	101/28	2.91	NR-15

¹Abbreviations

S = Number of taxa

EPTS = Number of EPT taxa

A & C S = Number of species of amphipods and caridean shrimps

BI = Biotic Index

BIEPT = Biotic Index of EPT taxa

E BI = Estuarine Biotic Index

G = Good

G-F = Good-Fair

NR = not rated

*These samples were collected using a petite Ponardredge, and thus, should not be compared with samples collected by sweep.

Fish Tissue Criteria

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with:

- Federal Food and Drug Administration (FDA) action levels.
- Environmental Protection Agency (EPA) recommended screening values.
- Criteria adopted by the North Carolina State Health Director. Refer to Table 1 below.

Sample results which exceed these levels are a human health concern and are evaluated by the NC Division of Occupational and Environmental Epidemiology at DWQ's request.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs, and thus, employ a "safe level" approach to fish tissue consumption. Presently, the FDA has only developed metals criteria for mercury.

The EPA has recommended screening values for target analytes which are formulated from a risk assessment procedure (EPA, 1995). These are the concentrations of analytes in edible fish tissue that are of potential public health concern. DWQ compares fish tissue results with EPA screening values to evaluate the need for further intensive site-specific monitoring.

Table A-II-2 Fish Tissue Criteria

Contaminant	FDA Action Levels	US EPA Screening Values	NC Health Director
Metals			
Cadmium		10.0	
Mercury	1.0	0.6	
Selenium		50.0	5.0
Organics			
Aldrin	0.3		
Chlordane		30	
Total chlordane ¹		0.08	
Cis-chlordane	0.3		
Trans-chlordane	0.3		
Total DDT ²		0.3	
Dieldrin		0.007	
Dioxins (total)		0.7	3.0
Endosulfan (I and II)		60.0	
Endrin	0.3	3.0	
Heptachlor epoxide		0.01	
Hexachlorobenzene		0.07	
Lindane		0.08	
Mirex		2.0	
Total PCBs		0.01	
PCB-1254	2.0		
Toxaphene		0.1	

¹ Total chlordane includes the sum of cis- and trans- isomers as well as nonachloroxychlordane.

² Total DDT includes the sum of all isomers and metabolites (i.e., p,p DDT, o,p DDT, DDE, and DDD).

Note: All wet weight concentrations are reported in parts per million (ppm, µg/g), except for dioxin which is in parts per trillion (ppt, pg/g).

The North Carolina State Health Director has adopted a selenium limit of 5 µg/g for issuing an advisory. Although the EPA has suggested a screening value of 0.7 ppt (pg/g) for dioxins, the State of North Carolina currently uses a value of 3.0 ppt in issuing an advisory.

Table A-II-2 Wet Weight Concentrations of Mercury (Hg), Arsenic (As), Cadmium (Cd) and Total Chromium (Crt) in Fish Tissue from the White Oak River Basin, 1994-1999

Site	County	Date	Species	Length (cm)	Weight (g)	Hg (ug/g)	As (ug/g)	Cd (ug/g)	Crt (ug/g)
Brinson Creek	Onsbw	04/01/98	<i>Amia calva</i>	55.3	1562	0.29	ND	ND	ND
			<i>Amia calva</i>	60.8	2300	0.25	ND	ND	ND
			<i>Lepomis gibbosus</i>	9.95	20.5	0.04	ND	ND	ND
			<i>Lepomis gibbosus</i>	15.2	93	0.08	ND	ND	ND
			<i>Lepomis gibbosus</i>	16	98	0.10	ND	ND	ND
			<i>Micropterus salmoides</i>	30	417	0.26	ND	ND	ND
			<i>Micropterus salmoides</i>	31.5	598	0.12	ND	ND	ND
			<i>Micropterus salmoides</i>	32.5	465	0.31	ND	ND	ND
			<i>Micropterus salmoides</i>	33	589	0.16	ND	ND	ND
			<i>Micropterus salmoides</i>	33.7	579	0.14	ND	ND	ND
			<i>Micropterus salmoides</i>	34.5	520	0.92	ND	ND	ND
			<i>Micropterus salmoides</i>	34.5	605	0.25	ND	ND	ND
			<i>Micropterus salmoides</i>	34.5	695	0.28	ND	ND	ND
			<i>Micropterus salmoides</i>	36	666	0.25	ND	ND	ND
			<i>Micropterus salmoides</i>	36	677	0.27	ND	ND	ND
			<i>Micropterus salmoides</i>	36.7	733	0.34	ND	ND	ND
			<i>Micropterus salmoides</i>	36.7	734	0.27	ND	ND	ND
			<i>Micropterus salmoides</i>	37.5	878	0.32	ND	ND	ND
			<i>Micropterus salmoides</i>	38.8	1036	0.30	ND	ND	ND
			<i>Micropterus salmoides</i>	40	875	0.32	ND	ND	ND
<i>Micropterus salmoides</i>	41.2	1275	0.30	ND	ND	ND			
New River above Jacksonville	Onsbw	07/16/97	<i>Ameiurus catus</i>	29.8	366.5	0.12	ND	ND	ND
			<i>Amia calva</i>	44.2	839	0.16			
			<i>Amia calva</i>	47.7	1020	0.24			
			<i>Amia calva</i>	48.4	1097	0.30	ND	ND	ND
			<i>Amia calva</i>	52.8	1425	0.32			
			<i>Amia calva</i>	53.8	1713	0.19			
			<i>Amia calva</i>	54.8	1647	0.31	ND	ND	ND
			<i>Amia calva</i>	55.7	1847	0.43	ND	ND	ND
			<i>Lepomis auritus</i>	18.7	121	0.08	ND	ND	ND
			<i>Lepomis auritus</i>	20.5	274	0.07	ND	ND	ND
			<i>Lepomis auritus</i>	23	245	0.15			
			<i>Lepomis auritus</i>	24	285	0.10			
			<i>Lepomis auritus</i>	25.4	358	0.36	ND	ND	ND
			<i>Lepomis gibbosus</i>	13.3	55.5	0.24			
			<i>Lepomis gibbosus</i>	15.8	91.5	0.08			
			<i>Lepomis gibbosus</i>	16.2	96	0.08			
			<i>Lepomis gibbosus</i>	18	129	0.15	ND	ND	ND
			<i>Lepomis macrochirus</i>	19.3	189	0.09	ND	ND	ND
			<i>Lepomis macrochirus</i>	21.1	228	0.18			
			<i>Lepomis macrochirus</i>	21.5	267	0.15	ND	ND	ND
			<i>Lepomis macrochirus</i>	21.7	281	0.20			
			<i>Lepomis macrochirus</i>	21.8	264	0.16	ND	ND	ND
			<i>Lepomis macrochirus</i>	22	265	0.28			
			<i>Lepomis macrochirus</i>	23.2	326	0.24			
			<i>Micropterus salmoides</i>	26.5	240	0.19	ND	ND	ND
			<i>Micropterus salmoides</i>	27.8	334	0.22			
			<i>Micropterus salmoides</i>	29	361	0.16	ND	ND	ND
			<i>Micropterus salmoides</i>	33.2	514	0.23			
			<i>Micropterus salmoides</i>	33.7	559	0.25			
			<i>Micropterus salmoides</i>	36.9	703	0.30	ND	ND	ND

Site	County	Date	Species	Length (cm)	Weight (g)	Hg (ug/g)	As (ug/g)	Cd (ug/g)	Crt (ug/g)
Northeast Creek above NC 24	Onsbw	04/01/98	<i>Lepomis gibbosus</i>	13.7	59.6	0.12	ND	ND	0.39
			<i>Lepomis gibbosus</i>	14.9	84.3	0.09	ND	ND	0.35
			<i>Lepomis gibbosus</i>	15.9	98.3	0.09	ND	ND	ND
			<i>Lepomis microlophus</i>	17.8	142.5	0.10	ND	ND	ND
			<i>Lepomis microlophus</i>	20	172	0.06	ND	ND	ND
			<i>Lepomis microlophus</i>	21	215	0.23	ND	ND	ND
			<i>Lepomis microlophus</i>	22	224	0.27	ND	ND	ND
			<i>Lepomis microlophus</i>	24.2	309	0.27	ND	ND	ND
			<i>Lepomis microlophus</i>	25	362	0.27	ND	ND	ND
			<i>Micropterus salmoides</i>	26.1	247	0.91	ND	ND	ND
			<i>Micropterus salmoides</i>	27.6	317	0.20	ND	ND	ND
			<i>Micropterus salmoides</i>	28.4	326	0.21	ND	ND	ND
			<i>Micropterus salmoides</i>	28.6	336	0.27	ND	ND	ND
			<i>Micropterus salmoides</i>	33.1	555	0.28	ND	ND	0.41
			<i>Micropterus salmoides</i>	33.5	530	0.50	ND	ND	ND
			<i>Micropterus salmoides</i>	37.8	833	0.71	ND	ND	ND
			<i>Micropterus salmoides</i>	38.5	1004	0.30	ND	ND	ND
			<i>Micropterus salmoides</i>	40.5	1175	0.34	ND	ND	ND
			<i>Micropterus salmoides</i>	42.5	1435	0.45	ND	ND	ND

ND = non detect. Detection levels were 1 ug/g for arsenic, 0.1 ug/g for cadmium, and 0.25 ug/g for chromium (total).