

NC DIVISION OF WATER RESOURCES (NCDWR) BASELINE ASSESSMENT OF FISH TISSUE METALS IN THE DAN RIVER FOLLOWING THE EDEN COAL ASH SPILL.

Key Findings

- Historic fish tissue metals data from the North Carolina segment of the Dan River is limited to two sites, with the most recent collections in 2005. However, the results of the current NCDWR fish tissue assessment (Table 1) are similar to these historic observations, both in species composition and levels of mercury, arsenic, cadmium, chromium, copper, nickel, lead and zinc.
- **Mercury** was detected in all 112 processed fish tissue samples from the Dan River (Table 1). The NC Division of Public Health (NCDPH) fish consumption action level for mercury (0.4 mg/kg) was exceeded in four Largemouth Bass fillet samples from Danville, VA and one Golden Redhorse fillet from above the Dan River Steam Station in Eden. *North Carolina's statewide mercury advisory has been in place since 2001. The state of Virginia has also issued fish consumption advisories for mercury and PCBs in the Dan River.*
- **Selenium** was also detected in all 112 fish samples from the Dan River (range = 0.17 – 0.79 mg/kg) (Table 1). All selenium concentrations in fish tissues were well below the NCDPH fish consumption action level of 10.0 mg/kg.
- The NCDPH screening value for **arsenic** and for **cadmium** was exceeded in one fish each (Table 1). The screening value for total arsenic (0.27 mg/kg) was exceeded in one Redear Sunfish fillet from Danville, VA (0.30 mg/kg). The screening value for cadmium (0.41 mg/kg) was exceeded in one Largemouth Bass whole body sample from the Berry Hill site (0.93 mg/kg).
- The NCDPH screening value for **thallium** (0.00412 mg/kg) (Appendix 3) may have been exceeded in one Redbreast Sunfish fillet collected from upstream of the steam plant in Eden (0.13 mg/kg); however the sample analysis failed to meet established quality control criteria and may be lower or higher than reported.
- Although most samples in this assessment were processed as fillets (74%), many of the highest concentrations of metals were observed in whole body sample types. NCDPH uses only fillet concentrations to determine if fish consumption advisories will be recommended for persons ingesting fish.

Introduction

In late February and early March of 2014, the NCDWR collected fish tissue samples from the Dan River for a baseline assessment of heavy metals following the February 2-6 coal ash spill in Eden, NC. This data is considered "baseline" because little historic NCDWR metals data exists for Dan River fish and insufficient time had passed (fish collections for this assessment were completed roughly one month following the spill) for the fish to bioaccumulate the metals associated with coal ash. The five sampling stations from upstream of the Dan River Steam Station to the headwater flats of Kerr Reservoir (approximately 80 river miles) were sampled from February 24th to March 5th using a 7.5 GPP boat mounted electrofisher (Appendix 1). Fish tissue samples were then processed and analyzed at the NCDWR Water Sciences Section (WSS) laboratories in Raleigh, NC according to the NCDWR fish tissue contaminant SOP (<http://portal.ncdenr.org/web/wq/ess/isu>) and according to United States Environmental Protection Agency (EPA) methods 245.6 (CVAA), 200.7 (ICP) and 200.8 (ICPMS).

A total of 18 species were collected during this initial assessment including Largemouth Bass, sunfish, sucker species, and catfish species. Processed fish tissue samples were tested for the following 16 metals: aluminum (Al), arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl) and zinc (Zn). There are currently North Carolina fish consumption action levels established for mercury (0.4 mg/kg) and selenium (10.0 mg/kg). Fish tissue screening values have been developed by NCDPH for 18 other metals since the Dan River Coal Ash Spill (Appendix 2).

Generic reference wildlife screening values are also available for mercury, selenium and arsenic for comparison to these data (Appendix 3). However, concentrations of metals in fish fillets or whole body samples may not be representative of the specific diets of predatory fish and aquatic-dependant wildlife, and therefore may not be ideal for wildlife risk assessments. The values in Appendix 3 are provided for a general wildlife screen of fish tissue metals data, but have not been formally adopted by NCDWR or any other agency.

NCDWR is conducting periodic follow up sampling to determine if the coal ash release results in increased metal concentrations in Dan River fish species.

General Observations

The practical quantitation limit (PQL), represents the lowest analytical value in which laboratory tests can determine a value amount for a named chemical in any given sample type. This is separate from the NCDPH screening value which uses only fillet samples in the determination of potential human health impacts.

Aluminum (Al) – Forty of the 112 aluminum concentrations observed (36%) were equal to or above the laboratory practical quantitation limit (PQL) of 1.0 mg/kg with a range of 1.0 to 110.0 mg/kg. The highest two concentrations (110 and 100.0 mg/kg, respectively) occurred in Gizzard Shad whole body samples collected from the headwaters of Kerr Reservoir in Virginia. However, all detections in fillets were well below the NCDPH screening value of 410 mg/kg.

Arsenic (As) – Fourteen observations of total arsenic (12.5%) were reported at or above the laboratory PQL (0.10 mg/kg), with a range of 0.10 to 0.30 mg/kg. The highest concentration of arsenic was observed in a Redear Sunfish fillet from the Danville, VA site which exceeded the NCDPH fish tissue screening value for total arsenic (0.27 mg/kg). However, no arsenic values met or exceeded the wildlife reference screening value of 1.3 mg/kg.

Barium (Ba) – Fifty observations (45%) were reported at or above the laboratory PQL of 0.20 mg/kg. Concentrations ranged from 0.20 to 7.7 mg/kg, with the highest occurring in a Bull Chub whole body sample from the Eden site. None approached the NC screening value of 82.0 mg/kg. All analytical observations were qualified as J2 because there is no available standard reference material for the method used in determining barium in fish tissues.

Cadmium (Cd) – Three observations of cadmium (3%) were detected above the laboratory PQL of 0.10 mg/kg. Of these three, only one was above the NCDPH cadmium screening level, a Largemouth Bass whole body sample with a value of 0.41 mg/kg.

Chromium (Cr)– Chromium was detected above the laboratory PQL in 13 samples (12%), 12 of which occurred in whole body sample types of low to mid trophic level species. The highest concentration of 0.93 mg/kg was observed in a Comely Shiner whole body composite from Danville, VA. However, none of the chromium observations met or exceeded the NCDPH screening value of 1.2 mg/kg.

Copper (Cu)– All observations (100%) were detected above the laboratory PQL of 0.10 mg/kg, with a range of 0.12 to 1.9 mg/kg. The highest two concentrations were observed in Comely Shiner whole body composite samples collected from the Berry Hill and Danville sites (1.3 and 1.9 mg/kg respectively). All observations of copper were well below the NCDPH screening value of 16.0 mg/kg.

Iron (Fe)– Iron was detected above the laboratory PQL of 1.0 mg/kg in all but one sample (99%), with a range of 1.10 to 130.0 mg/kg. The highest concentrations were observed in whole body sample types of multiple fish species. However, none approached the NC screening value of 290 mg/kg.

Lead (Pb)– Seven observations (6%) were detected above the laboratory PQL of 0.10 mg/kg. Concentrations ranged from 0.11 to 16.0 mg/kg, with the highest occurring in a Largemouth Bass whole body sample from the Berry Hill site. No screening value is available in NC for the comparison of lead in fish tissues.

Magnesium (Mg)– All of the fish tissue observations for magnesium (100%) were detected well above the laboratory PQL of 2.0 mg/kg. Concentrations ranged from 170 to 590 mg/kg, with the highest few occurring in Redbreast and Bluegill Sunfish whole body samples. No screening value is available in NC for the comparison of magnesium in fish tissues.

Manganese (Mn)– Sixty-nine observations of manganese (62%) were detected above the laboratory PQL of 0.20 mg/kg. Concentrations ranged from 0.20 to 35.0 mg/kg, with the highest value in a Gizzard Shad whole body composite sample from the headwaters of Kerr Reservoir. No fish tissue samples met or exceeded the NCDPH screening value of 58.0 mg/kg.

Mercury (Hg)–All mercury observations (100%) were detected above the PQL (0.02 mg/kg) in all fillet and whole body samples. Range of concentrations was 0.02 to 0.64 mg/kg. Five of these observations (4%, all fillets) exceeded the NC fish consumption action level of 0.4 mg/kg, with the highest concentration occurring in an 18 inch largemouth bass fillet sample from the Danville, VA site. Nearly all of the observations of mercury were also in range of or greater than the wildlife reference screening values of 0.03 to 0.1 mg/kg.

Nickel (Ni)– Thirty-two observations (29%) were detected at or above the laboratory PQL of 0.10 mg/kg. Nickel concentrations ranged from 0.10 to 1.0 mg/kg. Twenty-nine of these detections were observed in whole body fish samples that were collected from all five sample sites. All nickel results were well below the NCDPH screening value of 8.2 mg/kg.

Selenium (Se)– All of the selenium observations (100%) were detected above the laboratory PQL of 0.10 mg/kg. Concentrations ranged from 0.17 to 0.79 mg/kg, with no clear differences between species or trophic guilds. All selenium concentrations were more than 10 fold lower than the NC fish consumption action level of 10.0 mg/kg. The majority of selenium observations (91%) were less than the wildlife reference screening value of 0.6 mg/kg.

Silver (Ag)– No observations of silver in fish tissues from the Dan River (0%) were detected above the laboratory PQL of 0.10 mg/kg. The NCDPH screening value for silver in fish tissue is 2.1 mg/kg.

Thallium (Tl)– Thallium was detected above the laboratory PQL of 0.10 mg/kg in one Redbreast Sunfish fillet sample with a concentration of 0.13 mg/kg. This one observation from the Eden site upstream of the Dan River Steam Station may have exceeded the NCDPH screening value of 0.00412 mg/kg. However, all observations of thallium were qualified (J2) because there is no available standard reference material for the method used in determining this element in fish tissue. The thallium PQL is higher than the NCDPH screening value.

Zinc (Zn)– Zinc was detected above the laboratory PQL in 100% of the Dan River fish samples with a range of 2.9 to 70.0 mg/kg. The highest two concentrations were observed in the Comely Shiner whole body samples collected from the Danville VA and Berry Hill NC sites (52.0 and 70.0 mg/kg, respectively). All observations were lower than the NCDPH screening value of 120 mg/kg.

Table 1 continued.

Site Location	Date Coll.	DWR # ¹	Species	Sample Type ²	TL (mm)	Wt (g)	Analyte (mg/kg wet weight)																
							Hg	As	Cd	Cr	Cu	Ni	Pb	Zn	Se	Al	Tl	Fe	Mg	Ba	Mn	Ag	
E1 Danville VA	2/28/14	14-40	Largemouth Bass	F	490	2025	0.61	<0.10	<0.10	<0.20	0.12	<0.10	<0.10	3.80	0.35 *	<1.00	<0.10 *	1.70 *	260.00	<0.20 *	<0.20	<0.10	
		14-41	Largemouth Bass	F	490	1988	0.53	<0.10	<0.10	<0.20	0.16	<0.10	<0.10	<0.10	4.30	0.45 *	<1.00	<0.10 *	1.90 *	260.00	<0.20 *	<0.20	<0.10
	"	14-42	Largemouth Bass	F	457	1470	0.64	<0.10	<0.10	<0.20	0.19	<0.10	<0.10	<0.10	3.60	0.42 *	<1.00	<0.10 *	2.70 *	220.00	<0.20 *	<0.20	<0.10
	"	14-43	Largemouth Bass	F	403	968	0.56	<0.10	<0.10	<0.20	0.20	<0.10	<0.10	<0.10	4.40	0.33 *	<1.00	<0.10 *	1.90 *	240.00	<0.20 *	<0.20	<0.10
	"	14-44	Largemouth Bass	F	372	733	0.33	<0.10	<0.10	<0.20	0.16	<0.10	<0.10	<0.10	3.80	0.42 *	<1.00	<0.10 *	1.40 *	240.00	<0.20 *	<0.20	<0.10
	"	14-46	Largemouth Bass	F	312	377	0.36	<0.10	<0.10	<0.20	0.22	<0.10	<0.10	<0.10	4.40	0.32 *	<1.00	<0.10 *	2.20 *	240.00	<0.20 *	<0.20	<0.10
	"	14-47	Largemouth Bass	WC3	305	364	0.18	<0.10	<0.10	<0.20	0.26	0.39	<0.10	<0.10	13.00	0.38 *	3.20	<0.10 *	13.00 *	440.00	0.82 *	1.20	<0.10
	"	14-48	Redear Sunfish	F	327	675	0.21	0.30	<0.10	<0.20	0.25	<0.10	<0.10	<0.10	6.60	0.48 *	1.10	<0.10 *	2.40 *	210.00	<0.20 *	<0.20	<0.10
	"	14-49	Redear Sunfish	F	228	191	0.20	<0.10	<0.10	<0.20	0.36	<0.10	<0.10	<0.10	6.30	0.44 *	<1.00	<0.10 *	2.10 *	220.00	<0.20 *	<0.20	<0.10
	"	14-50	Redear Sunfish	F	218	175	0.21	<0.10	<0.10	<0.20	0.21	<0.10	<0.10	<0.10	9.10	0.48 *	<1.00	<0.10 *	1.90 *	210.00	<0.20 *	<0.20	<0.10
	"	14-51	Redear Sunfish	W	219	152	0.12	<0.10	<0.10	<0.20	0.27	0.48	<0.10	<0.10	21.00	0.57 *	34.00	<0.10 *	72.00 *	440.00	2.00 *	7.90	<0.10
	"	14-52	Redear Sunfish	W	120	22	0.06	<0.10	<0.10	<0.20	0.33	0.53	<0.10	<0.10	18.00	0.41 *	1.90	<0.10 *	11.00 *	440.00	2.10 *	7.90	<0.10
	"	14-53	Redbreast Sunfish	F	177	85	0.07	<0.10	<0.10	<0.20	0.30	<0.10	<0.10	<0.10	5.90	0.35 *	<1.00	<0.10 *	3.00 *	190.00	<0.20 *	0.20	<0.10
	"	14-54	Redbreast Sunfish	W	123	31	0.07	<0.10	<0.10	<0.20	1.20	0.52	<0.10	<0.10	24.00	0.61 *	16.00	<0.10 *	41.00 *	460.00	1.80 *	4.60	<0.10
	"	14-55	Golden Redhorse	F	350	399	0.34	<0.10	<0.10	<0.20	0.27	<0.10	0.11	5.10	0.37 *	<1.00	<0.10 *	4.30 *	220.00	0.23 *	1.30	<0.10	
	"	14-56	Channel Catfish	F	300	178	0.08	<0.10	<0.10	<0.20	0.22	<0.10	<0.10	<0.10	4.00	0.24 *	<1.00	<0.10 *	3.00 *	200.00	<0.20 *	<0.20	<0.10
	"	14-57	Comely Shiner	WC4	94	6	0.06	<0.10	<0.10	0.93	1.90	0.31	<0.10	<0.10	52.00	0.32 *	2.20	<0.10 *	17.00 *	300.00	2.90 *	3.20	<0.10
F1 Milton NC	2/25/14	14-58	Notchlip Redhorse	F	461	1130	0.18	<0.10	<0.10	<0.20	0.41	<0.10	<0.10	4.70	0.27	<1.00	<0.10 *	6.90	250.00	0.35 *	0.91	<0.10	
		14-60	Notchlip Redhorse	F	440	1075	0.08	<0.10	<0.10	<0.20	0.38	<0.10	<0.10	<0.10	4.40	0.26	<1.00	<0.10 *	4.20	270.00	0.20 *	0.58	<0.10
	"	14-61	Notchlip Redhorse	F	482	1331	0.21	<0.10	<0.10	<0.20	0.43	<0.10	<0.10	<0.10	4.80	0.44	<1.00	<0.10 *	5.90	250.00	0.27 *	0.91	<0.10
	"	14-62	Notchlip Redhorse	F	439	956	0.10	<0.10	<0.10	<0.20	0.39	<0.10	<0.10	<0.10	5.40	0.28	1.50	<0.10 *	4.40	250.00	0.28 *	0.69	<0.10
	"	14-63	Notchlip Redhorse	F	430	864	0.09	0.10	<0.10	<0.20	0.28	<0.10	<0.10	<0.10	4.20	0.37	<1.00	<0.10 *	3.30	250.00	0.23 *	0.71	<0.10
	"	14-64	Notchlip Redhorse	F	515	1731	0.20	<0.10	<0.10	<0.20	0.31	<0.10	<0.10	<0.10	5.60	0.25	<1.00	<0.10 *	4.80	250.00	0.38 *	1.00	<0.10
	"	14-65	Notchlip Redhorse	WC3	483	1377	0.07	<0.10	<0.10	<0.20	0.50	0.32	<0.10	<0.10	14.00	0.52	4.00	<0.10 *	16.00	420.00	3.10 *	10.00	<0.10
	"	14-66	Notchlip Redhorse	WC3	461	1306	0.07	<0.10	<0.10	<0.20	0.40	0.20	<0.10	<0.10	12.00	0.40	3.00	<0.10 *	12.00	350.00	1.80 *	6.70	<0.10
	"	14-67	Shorthead Redhorse	F	405	781	0.08	<0.10	<0.10	<0.20	0.33	<0.10	<0.10	<0.10	4.50	0.36	<1.00	<0.10 *	5.20	280.00	0.41 *	1.30	<0.10
	"	14-68	Shorthead Redhorse	F	405	869	0.10	<0.10	<0.10	<0.20	0.30	<0.10	<0.10	<0.10	4.40	0.28	<1.00	<0.10 *	3.60	250.00	0.32 *	1.40	<0.10
	"	14-69	Shorthead Redhorse	F	425	1043	0.08	<0.10	<0.10	<0.20	0.33	<0.10	<0.10	<0.10	4.10	0.39	<1.00	<0.10 *	3.80	260.00	0.33 *	1.30	<0.10
	"	14-71	Golden Redhorse	F	369	538	0.12	<0.10	<0.10	<0.20	0.39	<0.10	<0.10	<0.10	4.60	0.34	<1.00	<0.10 *	4.50	260.00	<0.20 *	1.10	<0.10
	"	14-72	White Sucker	W	302	288	0.06	<0.10	<0.10	<0.20	0.68	0.18	<0.10	<0.10	13.00	0.36	30.00	<0.10 *	51.00	350.00	1.40 *	11.00	<0.10
	"	14-73	White Sucker	F	290	279	0.08	<0.10	<0.10	<0.20	0.41	<0.10	<0.10	<0.10	4.90	0.32	<1.00	<0.10 *	3.70	260.00	<0.20 *	0.99	<0.10
"	14-74	Redbreast Sunfish	F	145	64	0.05	<0.10	<0.10	<0.20	0.34	<0.10	<0.10	<0.10	6.40	0.34	<1.00	<0.10 *	3.60	170.00	<0.20 *	0.76	<0.10	
"	14-75	Bluegill Sunfish	F	170	102	0.04	<0.10	<0.10	<0.20	0.16	<0.10	<0.10	<0.10	4.50	0.18	<1.00	<0.10 *	1.30	220.00	<0.20 *	<0.20	<0.10	
"	14-76	Bluegill Sunfish	W	106	20	0.04	<0.10	<0.10	0.20	0.32	0.31	<0.10	<0.10	20.00	0.42	45.00	<0.10 *	50.00	370.00	2.40 *	29.00	<0.10	

Table 1 continued.

Site Location	Date Coll.	DWR # ¹	Species	Sample Type ²	TL (mm)	Wt (g)	Analyte (mg/kg wet weight)															
							Hg	As	Cd	Cr	Cu	Ni	Pb	Zn	Se	Al	Tl	Fe	Mg	Ba	Mn	Ag
H1 Kerr	3/5/14	14-77	Largemouth Bass	F	332	476	0.16	<0.10	<0.10	<0.20	0.22	<0.10	<0.10	4.30	0.30	<1.00	<0.10 *	2.20	270.00	<0.20 *	<0.20	<0.10
"	"	14-78	Largemouth Bass	F	311	463	0.10	0.12	<0.10	<0.20	0.23	<0.10	<0.10	4.10	0.32	<1.00	<0.10 *	1.40	260.00	<0.20 *	<0.20	<0.10
Flats	"	14-79	Largemouth Bass	F	297	393	0.14	0.10	<0.10	<0.20	0.20	<0.10	<0.10	4.10	0.35	<1.00	<0.10 *	2.00	260.00	<0.20 *	<0.20	<0.10
VA	"	14-80	Largemouth Bass	F	298	455	0.16	<0.10	<0.10	<0.20	0.21	0.16	<0.10	3.70	0.25	1.80	<0.10 *	1.60	250.00	<0.20 *	<0.20	<0.10
"	"	14-82	Largemouth Bass	F	280	302	0.21	<0.10	<0.10	<0.20	0.37	<0.10	<0.10	4.40	0.34	<1.00	<0.10 *	1.40	250.00	<0.20 *	<0.20	<0.10
"	"	14-83	Largemouth Bass	F	263	264	0.39	<0.10	<0.10	<0.20	0.24	<0.10	0.18	3.90	0.21	1.40	<0.10 *	1.70	230.00	<0.20 *	<0.20	<0.10
"	"	14-84	Largemouth Bass	WC4	219	149	0.10	<0.10	<0.10	<0.20	0.29	0.19	<0.10	11.00	0.38	4.90	<0.10 *	9.50	350.00	0.64 *	1.30	<0.10
"	"	14-85	Largemouth Bass	WC3	206	110	0.12	<0.10	<0.10	<0.20	0.29	0.24	<0.10	11.00	0.40	3.40	<0.10 *	10.00	370.00	0.66 *	1.80	<0.10
"	"	14-86	Black Crappie	F	240	201	0.07	0.15	<0.10	<0.20	0.28	<0.10	<0.10	4.50	0.35	<1.00	<0.10 *	1.40	250.00	<0.20 *	0.21	<0.10
"	"	14-87	White Crappie	F	325	543	0.11	<0.10	<0.10	<0.20	0.18	<0.10	<0.10	4.50	0.28	<1.00	<0.10 *	1.30	270.00	<0.20 *	0.20	<0.10
"	"	14-88	White Crappie	F	284	346	0.07	<0.10	<0.10	<0.20	0.24	<0.10	<0.10	4.30	0.35	<1.00	<0.10 *	1.20	260.00	<0.20 *	<0.20	<0.10
"	"	14-89	White Crappie	F	251	240	0.06	0.10	<0.10	<0.20	0.18	<0.10	<0.10	4.30	0.35	<1.00	<0.10 *	1.50	250.00	<0.20 *	<0.20	<0.10
"	"	14-90	White Crappie	F	251	251	0.06	<0.10	<0.10	<0.20	0.21	<0.10	<0.10	4.20	0.32	<1.00	<0.10 *	1.30	250.00	<0.20 *	<0.20	<0.10
"	"	14-91	White Crappie	F	260	251	0.07	<0.10	<0.10	<0.20	0.22	<0.10	<0.10	4.20	0.35	1.10	<0.10 *	1.40	250.00	<0.20 *	<0.20	<0.10
"	"	14-93	White Crappie	F	257	240	0.04	0.13	<0.10	<0.20	0.21	<0.10	<0.10	3.80	0.29	<1.00	<0.10 *	1.40	250.00	<0.20 *	<0.20	<0.10
"	"	14-94	White Crappie	F	255	262	0.07	<0.10	<0.10	<0.20	0.16	<0.10	<0.10	3.50	0.31	<1.00	<0.10 *	<1.0	260.00	<0.20 *	<0.20	<0.10
"	"	14-95	White Crappie	F	252	207	0.06	0.12	<0.10	<0.20	0.17	<0.10	<0.10	3.90	0.37	<1.00	<0.10 *	1.40	260.00	<0.20 *	<0.20	<0.10
"	"	14-96	White Crappie	WC3	235	182	0.04	0.17	<0.10	<0.20	0.26	0.19	<0.10	12.00	0.37 *	9.10	<0.10 *	18.00	330.00	0.89 *	2.90	<0.10
"	"	14-97	Bluegill Sunfish	F	177	98	0.07	<0.10	<0.10	0.41	0.29	0.20	<0.10 *	7.10	0.48 *	<1.00	<0.10 *	3.30	250.00	<0.20 *	0.42	<0.10 *
"	"	14-98	Bluegill Sunfish	F	165	85	0.07	<0.10	<0.10	<0.20	0.31	<0.10	<0.10 *	6.30	0.30 *	<1.00	<0.10 *	1.50	200.00	<0.20 *	0.28	<0.10 *
"	"	14-99	Bluegill Sunfish	F	161	80	0.12	<0.10	<0.10	<0.20	0.24	<0.10	<0.10	6.60	0.48 *	<1.00	<0.10 *	1.20	240.00	<0.20 *	0.27	<0.10
"	"	14-100	Bluegill Sunfish	F	163	65	0.10	<0.10	<0.10	<0.20	0.37	<0.10	<0.10 *	8.40	0.28 *	<1.00	<0.10 *	2.20	200.00	<0.20 *	0.79	<0.10 *
"	"	14-101	Bluegill Sunfish	F	155	71	0.05	<0.10	<0.10	<0.20	0.16	<0.10	<0.10 *	8.90	0.21 *	<1.00	<0.10 *	1.80	230.00	<0.20 *	0.27	<0.10 *
"	"	14-102	Bluegill Sunfish	F	155	73	0.09	<0.10	<0.10	<0.20	0.23	<0.10	0.42 *	7.20	0.61 *	<1.00	<0.10 *	3.10	250.00	<0.20 *	0.30	<0.10 *
"	"	14-104	Bluegill Sunfish	F	150	62	0.05	<0.10	<0.10	<0.20	0.46	<0.10	<0.10	7.50	0.33 *	<1.00	<0.10 *	2.00	250.00	<0.20 *	<0.20	<0.10
"	"	14-105	Bluegill Sunfish	WC5	136	44	0.07	<0.10	<0.10	0.30	0.50	1.00	<0.10	26.00	0.47 *	23.00	<0.10 *	37.00	590.00	3.20 *	23.00	<0.10
"	"	14-106	Bluegill Sunfish	WC5	124	32	0.05	<0.10	<0.10	<0.20	0.35	0.41	<0.10	19.00	0.53 *	5.70	<0.10 *	19.00	470.00	2.90 *	15.00	<0.10
"	"	14-107	Channel Catfish	F	448	694	0.11	<0.10	<0.10	<0.20	0.13	<0.10	<0.10	2.90	0.33 *	<1.00	<0.10 *	1.70	220.00	<0.20 *	<0.20	<0.10
"	"	14-108	Shorthead Redhorse	F	397	807	0.24	<0.10	<0.10	<0.20	0.36	<0.10	<0.10	4.60	0.28 *	<1.00	<0.10 *	4.40	270.00	0.27 *	0.90	<0.10
"	"	14-109	Gizzard Shad	F	312	272	0.03	<0.10	<0.10	<0.20	0.37	0.10	<0.10	5.20	0.43 *	<1.00	<0.10 *	8.00	230.00	1.20 *	4.60	<0.10
"	"	14-110	Gizzard Shad	F	313	245	0.04	<0.10	<0.10	<0.20	0.47	<0.10	<0.10	5.20	0.19 *	<1.00	<0.10 *	8.00	220.00	0.69 *	2.10	<0.10
"	"	14-111	Gizzard Shad	F	285	220	0.03	<0.10	<0.10	<0.20	0.39	<0.10	<0.10	4.60	0.48 *	<1.00	<0.10 *	7.90	230.00	0.41 *	3.10	<0.10
"	"	14-112	Gizzard Shad	W	227	100	0.03	<0.10	<0.10	0.27	0.97	0.44	<0.10	10.00	0.49 *	100.00	<0.10 *	130.00	320.00	4.60 *	23.00	<0.10
"	"	14-113	Gizzard Shad	WC4	112	11	0.20	0.14	<0.10	0.29	1.00	0.39	<0.10	16.00	0.69 *	110.00	<0.10 *	120.00	320.00	5.10 *	35.00	<0.10
"	"	14-114	Redear Sunfish	F	223	190	0.15	0.11	<0.10	<0.20	0.17	<0.10	<0.10	4.80	0.64 *	<1.00	<0.10 *	1.60	250.00	<0.20 *	<0.20	<0.10

Table 1 continued.

Site Location	Date Coll.	DWR # ¹	Species	Sample Type ²	TL (mm)	Wt (g)	Analyte (mg/kg wet weight)															
							Hg	As	Cd	Cr	Cu	Ni	Pb	Zn	Se	Al	Tl	Fe	Mg	Ba	Mn	Ag
"	"	14-116	Redear Sunfish	F	205	147	0.07	0.10	<0.10	<0.20	0.24	<0.10	<0.10	5.90	0.51	<1.00	<0.10 *	1.50	250.00	<0.20 *	<0.20	<0.10
"	"	14-117	Redear Sunfish	F	207	143	0.08	<0.10	<0.10	<0.20	0.20	<0.10	<0.10	5.10	0.64	<1.00	<0.10 *	1.80	250.00	<0.20 *	<0.20	<0.10
"	"	14-118	Redear Sunfish	F	199	137	0.12	<0.10	<0.10	<0.20	0.14	<0.10	<0.10	5.40	0.59	<1.00	<0.10 *	1.10	220.00	<0.20 *	<0.20	<0.10
"	"	14-119	Redear Sunfish	F	190	121	0.13	<0.10	<0.10	<0.20	0.15	<0.10	<0.10	5.30	0.40	<1.00	<0.10 *	1.60	240.00	<0.20 *	<0.20	<0.10
"	"	14-120	Redear Sunfish	WC3	189	112	0.06	0.13	<0.10	0.47	0.42	0.50	<0.10	17.00	0.65	31.00	<0.10 *	44.00	430.00	2.50 *	8.20	<0.10
"	"	14-121	Redear Sunfish	WC4	165	79	0.06	0.12	<0.10	0.26	0.32	0.44	<0.10	17.00	0.75	57.00	<0.10 *	58.00	460.00	2.50 *	8.30	<0.10
"	"	14-122	Redear Sunfish	WC4	170	84	0.06	<0.10	<0.10	0.21	0.33	0.35	<0.10	15.00	0.73	30.00	<0.10 *	37.00	420.00	1.80 *	6.50	<0.10

¹ DWR # - The following blind duplicate samples intended for laboratory quality control were removed (14-07, 14-18, 14-34, 14-45, 14-59, 14-70, 14-81, 14-92, 14-103 and 14-115).

² Sample Type - F = individual fillet, W = individual whole body, WC2 = whole body composite of 2, WC3 = whole body composite of 3, etc.

Bold data indicates analyte detection above the laboratory practical quantitation limit (PQL).

< indicates that the analyte was not detected above the reported PQL.

* indicates J2 Qualifier - estimated value - failed to meet established quality control criteria.

List of PQL's for analytes with all detections above the laboratory PQL

Hg = 0.02

Cu = 0.10

Zn = 0.20

Se = 0.10

Mg = 2.00

Method Reference

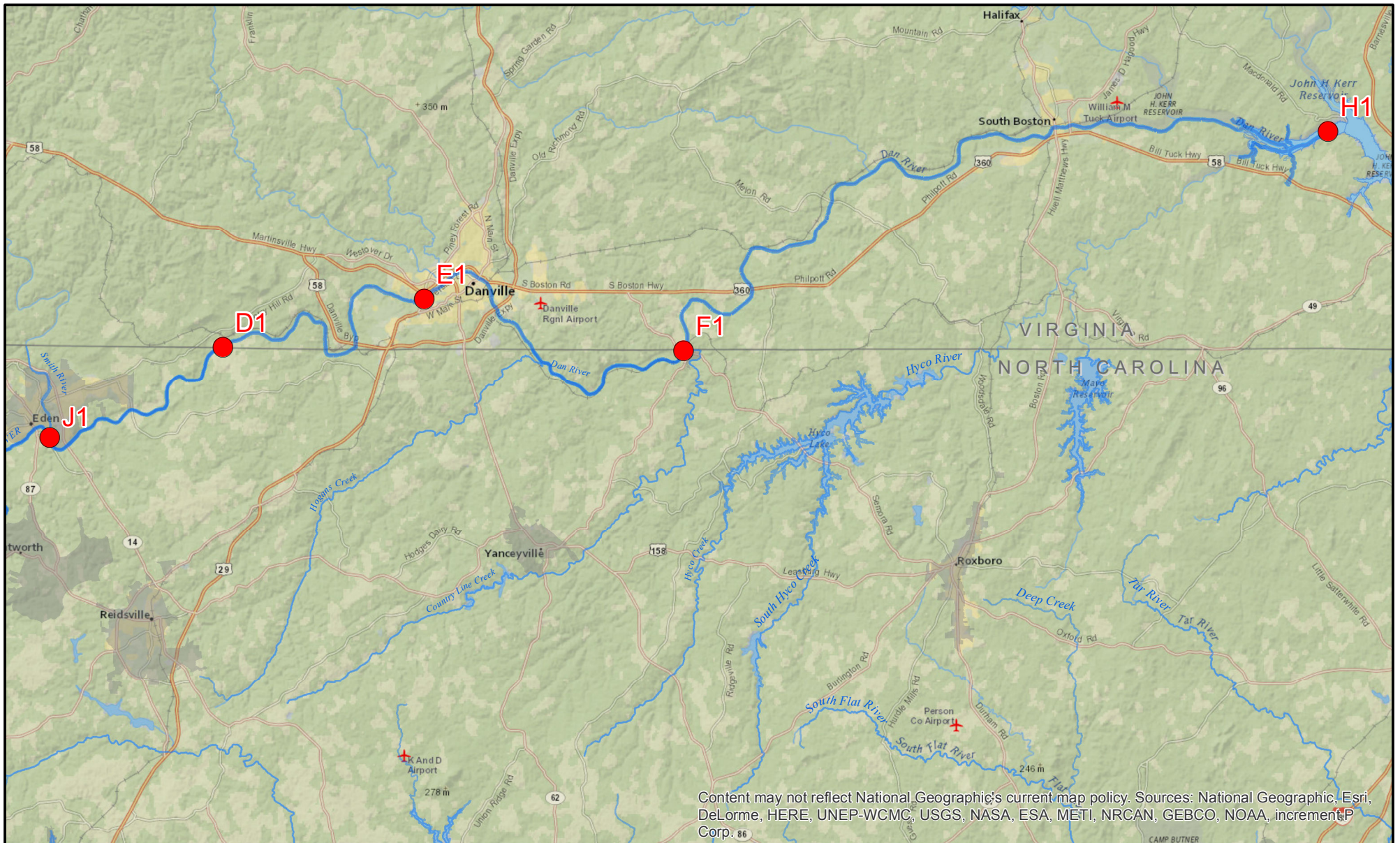
U.S. EPA - 245.6 - Hg

U.S. EPA - 200.3 - sample preparation for spectrochemical determination of total recoverable elements in biological tissues (precedes 200.7 and 200.8).

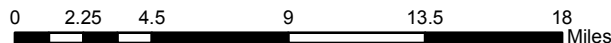
U.S. EPA - 200.7 - Al, Ba, Cr, Fe, Mg, Mn, Zn

U.S. EPA - 200.8 - Ag, As, Cd, Cu, Pb, Ni, Se, Tl

Duke Power Eden Coal Ash Spill - DWR Fish Tissue Monitoring Locations for Dan River



● Dan River Fish Tissue Monitoring Stations



Appendix 2. NCDPH Fish Tissue Screening Levels

North Carolina Division of Public Health Fish Tissue Screening Levels (ALs) for Human Ingestion Exposures for the Dan River Coal Ash Spill		
Metal	Screening Levels (µg/kg)	Screening Levels (mg/kg)
Aluminum	410,000	410
Antimony	160	0.16
Arsenic (as inorganic As)	27	0.027
Arsenic (as total As)	270	0.27
Barium	82,000	82
Beryllium	1600	1.6
Boron	82,000	82
Cadmium	410	0.41
Calcium	Not Available	Not Available
Chromium (VI)	1200	1.2
Cobalt	120	0.12
Copper	16,000	16
Iron	290,000	290
Lead	Not Available	Not Available
Lithium	820	0.82
Magnesium	Not Available	Not Available
Manganese	58,000	58
Nickel	8200	8.2
Silver	2100	2.1
Sodium	Not Available	Not Available
Thallium	4.1	0.00412
Vanadium	2,100	2.1
Zinc	120,000	120

Mercury (mg/kg)	Women of Childbearing Age (15 to 44 years) and Children (< 15 years)	Others
<0.4	2 meals per week	4 meals per week
0.4 to 1.0	Do not eat	1 meal per week
>1.0 to 3.0	Do not eat	1 meal per month
>3.0	Do not eat	Do not eat

Selenium (mg/kg)	Advisory
<10.0	No advisory
10 to 20	1 meal per week
>20 to 50	1 meal per month
>50	Do not eat

Notes:

- SVs based on fish ingestion rate of 170 g/day, Acceptable Cancer Risk Level of 1E-04, a 70 kg adult, and daily life-time exposure.
- All values as wet weight fillet tissue.
prepared September 16, 2014

Appendix 3. Generic Wildlife Screening Values

Mercury – 0.03 to 0.1 mg/kg wet weight (EPA 1997, Shore et al. 2011)^{1,2}

Selenium – 3.0 mg/kg dry weight – (about 0.6 mg/kg wet weight) (Ohlendorf and Heinze, 2011)³

Arsenic – 1.3 mg/kg wet weight (muscle tissue) (from Table 28.7 in Eisler 2000)⁴

¹ U.S. Environmental Protection Agency. 1997. Mercury report to Congress. Volume VII: Characterization of human health and wildlife risks from mercury exposure in the United States. Office of Air Quality Planning and Standards and Office of Research and Development. EPA-452-R-97-009.

² Shore RF, Pereira MG, Woshner V, Thompson DR. 2011. Mercury in Nonmarine Birds and Mammals. Pages 609-624 In: WN Beyer, JP Meador (Eds). Environmental Contaminants in Biota: Interpreting Tissue Concentrations, Second Edition. CRC Press, Boca Raton, FL.

³ Ohlendorf HM, Heinz GH. 2011. Selenium in Birds. Pages 669-701 In: WN Beyer, JP Meador (Eds). Environmental Contaminants in Biota: Interpreting Tissue Concentrations, Second Edition. CRC Press, Boca Raton, FL.

⁴ Eisler R. 2000. Handbook of Chemical Risk Assessment: Health Hazards to Humans, Plants, and Animals, Vol. 3. Lewis Publishers, Boca Raton, FL.