Evaluation of Metals in Fish from Virginia Watersheds in 2021

Multiple Watersheds Statewide

VIRGINIA

September 22, 2022

Virginia Department of Health
Office of Environmental Health Services
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September 22, 2022

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Dear Mr. Darkwah,

Thank you for providing metal concentrations in fish tissue for fish collected during the 2021 monitoring season. The Virginia Department of Health (VDH) has finished reviewing the results for public health implications as requested.

BACKGROUND

In 2021, fish were collected for two monitoring projects: annual statewide TMDL and the National Fish and Wildlife Foundation (NFWF) grant. The statewide TMDL follow up collections were concentrated primarily within watersheds of the James River (Chickahominy River, Elizabeth River system, four impoundments, etc.,), the New River and three impoundments in the Tennessee River drainage. Supplemental funding allowed for expanded fish collections from additional sites within the James River watershed as well as the Roanoke River watershed including several large reservoirs (Smith Mountain Lake, Leesville Lake, J. H. Kerr Reservoir and Lake Gaston). Four hundred fish tissue samples were analyzed for the statewide program.

Collections for the NFWF project were performed at sites located on the Dan River, Roanoke River, and the following impoundments: Lovills Creek Lake, J. H. Kerr Reservoir and Lake Gaston. 65 fish tissue samples were analyzed for the NFWF grant funded project. This resulted in 65 fish tissue samples for the NFWF project.

A total of 465 edible fillet samples were tested for 17 metal analytes during 2021. Fish collected were tested for beryllium (Be), aluminum (Al), vanadium (V), chromium (Cr), manganese (Mn), nickel (Ni), copper (Cu), zinc (Zn), arsenic (As), selenium (Se), silver (Ag), cadmium (Cd), antimony (Sb), barium (Ba), mercury (Hg), thallium (Tl), and lead (Pb). Of these metals, only two, arsenic and mercury, were observed to exceed VDH level of concern in some samples.

VDH's level of concern (0.5 parts per million (ppm)) for mercury was exceeded in 30 of 465 samples (6.5%). VDH's level of concern (0.09 ppm) for inorganic arsenic cancer health effects was exceeded in 15 of 465 samples (3.2%).

DISCUSSION

The 2021 fish tissue data was evaluated along with sampling data you provided from previous years (2018-2020) and the findings are presented in Table 1. The number of fish, size, species, and frequency were considered in determining the need for a mercury fish consumption advisory.

- The 2021 data supports keeping the mercury fish consumption advisories already in place at Big Cherry Reservoir, Kerr Reservoir, Dan River, Hyco River, Lovills Creek Lake, and the Roanoke River (see Table 1).
- There are several sampling locations on the Dan River, James River, Diascund Creek Reservoir, and Lake Gaston listed in Table 1 where mercury concentrations in fish are above VDH's screening value, 0.5 ppm. However, per our discussion on August 29, 2022, more sampling is needed to support issuing a mercury fish consumption advisory.
- The remaining sampling locations listed in Table 1 do not warrant a fish consumption advisory based on the VDH's review of the 2018-2021 data.

Table 1. Fish species with mercury concentrations that exceeded the Virginia Department of Health's screening value (0.5 parts per million).

Sampling location	Fish species	Number of fish	Mercury concentration (ppm)	Fish length (cm)
Mercury fish advisory exists				
Big Cherry Reservoir (South Fork Powell River)	Largemouth Bass	5	1.02	22.1 – 22.5
Big Cherry Reservoir (South Fork Powell River)	Largemouth Bass	1	0.98	37.2
Big Cherry Reservoir (South Fork Powell River)	Largemouth Bass	4	0.83	24.6 – 27.3
Dan River near Anglers Park below city of Danville	Flathead Catfish	1	0.97	109.6
Dan River near Anglers Park below city of Danville	Striped Bass	1	0.81	61.3
Dan River / Kerr Reservoir near State Park upper lake	Blue Catfish	1	0.76	95.1
Dan River / Kerr Reservoir near State Park upper lake	Blue Catfish	1	0.65	94.1
Dan River / Kerr Reservoir near State Park upper lake	Blue Catfish	2	0.53	82.5 – 82.8
Dan River / Kerr Reservoir near State Park upper lake	Blue Catfish	3	0.25	75.8 – 80.4
Hyco River near Route 58 bridge	Largemouth Bass	4	0.61	39.1 – 44.5
Kerr Reservoir near Island Creek Public Rec Area (Island Creek)	Striped Bass	4	0.55	54.7 – 57.0
Kerr Reservoir near Island Creek Public Rec Area (Island Creek)	Striped Bass	4	0.47	52.8 – 54.0
Kerr Reservoir near Island Creek Public Rec Area (Island Creek)	Striped Bass	4	0.41	51.5 – 52.5
Lovills Creek Lake	Largemouth Bass	2	0.75	51.6 – 53.1
Lovills Creek Lake	Largemouth Bass	2	0.47	44.8 – 50.1
Roanoke River near Rt. 746 bridge (Watkins Bridge) near Randolph	Walleye	3	0.66	46.6 – 64.7
Roanoke River near public boat ramp at Clover, VA	Striped Bass	1	0.63	55.1
Additional samples should be collected				
Dan River above Schoolfield Dam	Largemouth Bass	1	0.76	43.4
Dan River above Schoolfield Dam	Largemouth Bass	1	0.76	41.1
Dan River above Schoolfield Dam	Largemouth Bass	1	0.54	44.7
Dan River near NC-VA State Line at Rt. 880 bridge	Smallmouth Bass	1	1.05	49.8
Dan River near NC-VA State Line at Rt. 880 bridge	Smallmouth Bass	1	0.57	44.3
Dan River near NC-VA State Line at Rt. 880 bridge	Smallmouth Bass	1	0.50	31.0

Dan River near NC-VA State Line at Rt. 880 bridge	Smallmouth Bass	1	0.35	32.0
James River near Pony Pasture	Blue Catfish	1	0.97	103.2
James River near Pony Pasture	Blue Catfish	1	0.81	107.7
James River near Pony Pasture	Flathead Catfish	1	0.70	92.9
James River near Pony Pasture	Flathead Catfish	1	0.48	73.0
James River near Pony Pasture	Flathead Catfish	2	0.29	63.1 – 66.9
James River near Pony Pasture	Flathead Catfish	1	0.26	81.3
James River near Pony Pasture	Blue Catfish	1	0.14	70.8
James River near Pony Pasture	Blue Catfish	4	0.12	46.2 – 52.6
Lake Gaston, off Point (Mecklenburg County)	Largemouth Bass	2	0.52	44.0 – 44.6
Lake Gaston, off Point (Mecklenburg County)	Largemouth Bass	2	0.45	42.4 – 43.0
Lake Gaston, off Point (Mecklenburg County)	Largemouth Bass	2	0.37	41.2 – 41.6
Lake Gaston, off Point (Mecklenburg County)	Largemouth Bass	2	0.37	39.5 – 40.1
No advisory warranted based on review of data (2018 to 2021)				
Roanoke River near Bus Rt. 29 bridge, Altavista	Flathead Catfish	1	0.81	92.5
Roanoke River near Rt. 746 bridge (Watkins Bridge) near Randolph	Flathead Catfish	1	1.45	104.7
New River near Rt. 21/221	Smallmouth Bass	1	0.90	51.3
New River near Rt. 21/221	Smallmouth Bass	5	0.33	28.7 – 34.3
New River near Rt. 58 bridge	Flathead Catfish	1	0.70	67.2
New River near Rt. 58 bridge	Smallmouth Bass	2	0.55	42.0 – 44.2
New River near Rt. 58 bridge	Smallmouth Bass	3	0.31	35.6 – 37.7
Sandy River Reservoir near Dam Marrowbone Creek	Largemouth Bass	2	0.52	47.6 – 48.8
Sandy River Reservoir near Dam Marrowbone Creek	Largemouth Bass	5	0.15	31.2 – 34.6
Diascund Creek Reservoir	Bowfin	5	0.59	48.9 – 58.5

Inorganic arsenic makes up a small fraction of the total arsenic reported. VDH currently calculates the inorganic fraction as 10% of the total arsenic. This results in 10 fish samples with inorganic arsenic concentrations above VDH cancer screening value (0.09 ppm). These findings (Table 2) are similar to 2021 sampling where croaker and spot were the predominant fish species, although from other waterways, with concentrations of inorganic arsenic above VDH's screening value. In addition, the calculated inorganic arsenic in blue crab sampled in 2021 exceeded VDH's screening value.

Table 2. Samples with calculated inorganic that exceeded the Virginia Department of Health's screening value (0.09 parts per million).

Sampling location	Species	Number analyzed	Total arsenic concentration (ppm)	Calculated inorganic Arsenic (ppm)
James River near I-95	Hickory Shad	9	2.41	0.241
James River near Rt. 17 bridge	Croaker	9	0.99	0.099
James River near Rt. 17 bridge	Spot	18	1.16	0.116
Hampton River near Rt. 60/143 bridge	Croaker	6	1.39	0.139
Hampton River near Rt. 60/143 bridge	Spot	4	1.38	0.138
Mill Creek - middle	Croaker	8	1.44	0.144
Mill Creek - middle	Spot	3	3.43	0.343
Willoughby Bay	Bluefish	1	1.80	0.180
Elizabeth River near Craney Island	Croaker	8	0.96	0.096
Elizabeth River near Craney Island	Spot	11	0.96	0.096
Nansemond River near Rt. 17 bridge (City of Suffolk)	Blue Crab	11	1.03	0.103
Bennett Creek near Rt. 17 bridge	Blue Crab	10	0.98	0.098
Hampton River near Rt. 60/143 bridge	Blue Crab	12	3.93	0.393
Hampton River near Rt. 60/143 bridge	Blue Crab	10	3.51	0.351
Mill Creek - middle	Blue Crab	7	3.37	0.337

CONCLUSIONS

No changes to the current fish consumption advisories for mercury are warranted at this time.

Certain species of fish taken from the Dan River above Schoolfield Dam and near the North Carolina border in 2021 are above the Virginia Department of Health's screening value for mercury.

The concentration of mercury in largemouth bass, greater than 42 centimeters, taken from Lake Gaston in 2021 exceeds the Virginia Department of Health's screening value for mercury.

The concentration of mercury in flathead catfish and blue catfish sampled from the James River near Pony Pasture increases with the size of the fish.

The concentration of calculated inorganic arsenic in spot, croaker, and blue crab collected may be a health risk.

RECOMMENDATIONS

Additional analysis of largemouth bass from the Dan River above Schoolfield Dam and smallmouth bass near the North Carolina border is needed to determine if fish consumption advisory for mercury is warranted.

Additional analysis of flathead catfish and blue catfish of a range of sizes from the James River near Pony Pasture is needed to determine if a fish advisory is warranted.

Additional analysis of largemouth bass from Lake Gaston is needed to determine if a fish advisory is warranted.

Conduct a pilot study in tidal estuarine watersheds to determine the total and inorganic concentration of arsenic in croaker, spot, and blue crabs.

If you have any questions regarding this assessment, please email toxicology@vdh.virginia.gov or call (804) 864-8182.

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