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VIRGINIA WILD-CAUGHT BLUE CATFISH: NUTRITION AND CONTAMINANT ANALYSIS

INTRODUCTION

The blue catfish, *Ictalurus furcatus*, is an introduced freshwater species in Virginia's tributaries to the Chesapeake Bay. Since its introduction in the 1970's, significant recreational and commercial fisheries have developed within upriver, largely freshwater environments. Blue catfish are voracious, opportunistic predators, feeding on a variety of natural prey items, including native fish and shellfish species. Their varied diets result in a more nutrient-rich fish compared to farm-raised catfish (USDA Food and Nutrient Database <https://fdc.nal.usda.gov/fdc-app.html#/?query=catfish>) on the market, which are typically fed a plant-based diet.

In recent years, blue catfish populations have expanded from upriver freshwater habitat to major brackish-water sub-estuaries of the Chesapeake Bay. With this expansion into marine habitat, blue catfish are developing more tolerance to salt water, while overlapping habitat supporting native marine prey species, which may influence their nutrient profiles. This prey interaction with native species, and their rapid increase in total biomass within Virginia tidal tributaries, has labelled blue catfish as an invasive species negatively influencing the Chesapeake Bay watershed.

Efforts are underway by state and regional managers to expand commercial harvest to reduce pressure on native species and habitat. These efforts will be contingent upon adequate fish processing and diverse market expansion to maintain value in the fishery. Marketing strategies from harvest to consumption need to be developed to promote wild-caught blue catfish from the Chesapeake Bay.

New and updated nutrition and health information for the consumption of wild-caught blue catfish from Virginia is pivotal for marketing success. This document was prepared to help expand the volume and quality of blue catfish products, including

WILD-CAUGHT BLUE CATFISH FILLETS (SKIN-OFF)

Nutrition Facts	
varied servings per container	
Serving size	3 oz (85g)
Amount per serving	
Calories	70
% Daily Value*	
Total Fat 1g	1%
Saturated Fat 0g	0%
Trans Fat 0g	
Polyunsaturated Fat 0g	
Monounsaturated Fat 0g	
Cholesterol 45mg	15%
Sodium 40mg	2%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 15g	
Vitamin D 1.3mcg	6%
Calcium 10mg	0%
Iron 0mg	0%
Potassium 350mg	8%

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

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fillets (skin-off), bellies (nuggets), and roe ("caviar," bottarga). Nutritional information presented is from fish harvested in the lower James River, VA sub-estuary, and may be used for comparison to farm-raised or wild-caught freshwater catfish nutrient profiles. Due to habitat overlap of many native seasonal species within the James River sub-estuary, and therefore seasonal changes of available prey items, nutrient profiles were generated for fall and spring caught blue catfish.

Tributaries of the Chesapeake Bay have varying levels of chemical contaminants, and blue catfish is one of those species that bioaccumulate toxins with size and age; therefore, Methyl mercury and polychlorinated biphenyls (PCBs) levels are provided for review relative to state fish consumption advisories and FDA/EPA action levels.

SAMPLE PREPARATION

Nutritional and contaminant analyses were performed on blue catfish harvested by anchored gill nets from the Hog Island area in the James River sub-estuary (2.6-7ppt salinity range) during an ongoing blue catfish predation study at the Virginia Institute of Marine Science (VIMS). Harvested fish were transported on ice to VIMS fishery lab for processing.

For nutrient analysis, five female fish of size (56-62cm FL) and reproductive state (nearing maturity but not ripe, 1.25-3mm ova diameter) representing most marketable processed product forms (fillets, bellies, roe) were sampled on 11/19/2019 and 5/13/2020. From each of the five fish, the right fillet and right belly flap were removed and skinned for testing, and both (paired) roe sacs were removed for testing as a single sample. Samples were frozen separately for each product form and stored frozen until testing. Frozen samples were shipped to a third-party certified lab

WILD-CAUGHT BLUE CATFISH FILLETS (SKIN-OFF)

Nutrition Facts

varied servings per container
Serving size 4 oz (112g)

Amount per serving
Calories **90**

% Daily Value*

Total Fat 1.5g	2%
Saturated Fat 0g	0%
Trans Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 0g	
Cholesterol 60mg	20%
Sodium 55mg	2%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 19g	
Vitamin D 1.7mcg	8%
Calcium 10mg	0%
Iron 0mg	0%
Potassium 460mg	10%

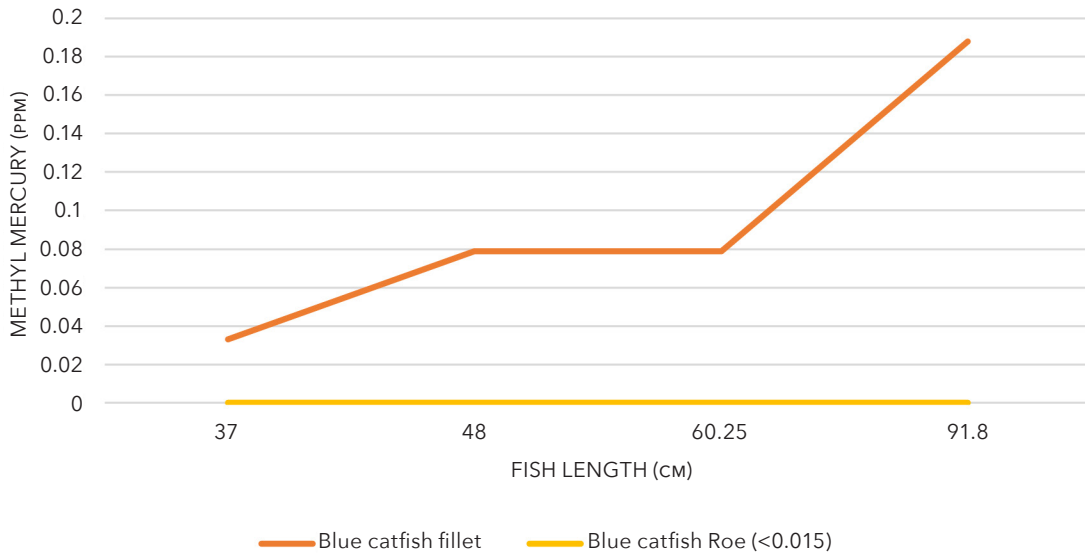
*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



PHOTO BY AILEEN DEVLIN/VIRGINIA SEA GRANT

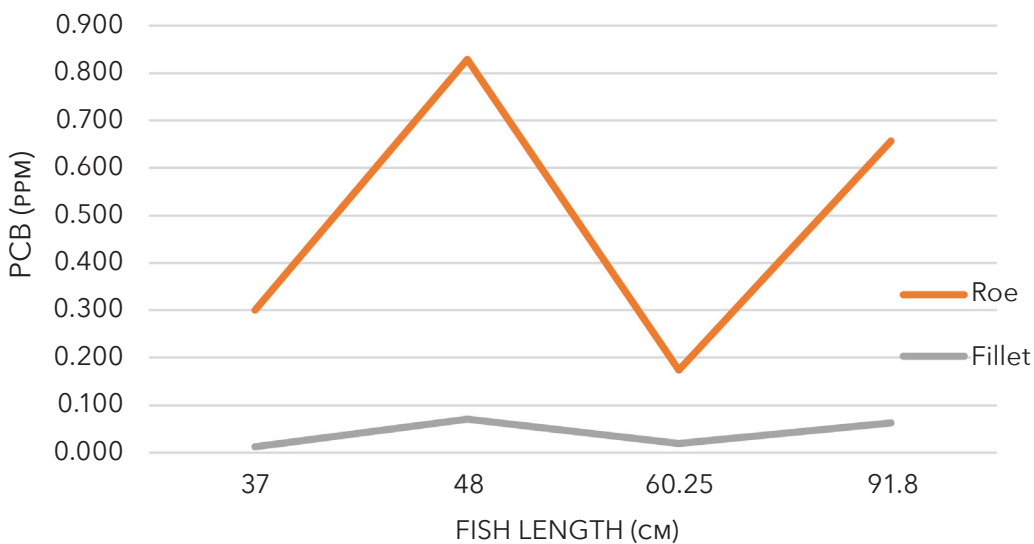
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METHYL MERCURY CONCENTRATIONS (PPM) IN BLUE CATFISH FILLETS AND ROE
(JAMES RIVER, MAY 2019)



Fish length (cm)	ppm	Fish length (cm)	ppm
37	0.033	60.25	0.079
48	0.079	91.8	0.188

BLUE CATFISH FILLET TOTAL PCBs



TOTAL PCBs DENOTES SUM OF POLYCHLORINATED BIPHENYL CONGENERS

(All quantifiable detected congeners are reported at <https://vaseagrant.org/wp-content/uploads/Catfish-PCB-Congeners-Detected-.xlsx>)

Fish length (cm)	fillet (ppm)	roe(ppm)	Fish length (cm)	fillet (ppm)	roe(ppm)
37	0.0123	0.300	60.25	0.0192	0.174
48	0.0706	0.829	91.8	0.0623	0.657

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(MERIEUX NutriSciences, Silliker, Inc, Gainesville Florida Laboratory) for nutrient analysis. Individual samples within each product form were thawed, homogenized, subsampled (3 oz from each of the 5), with subsamples composited for testing sample (15 oz).

Sampling for contaminant testing was performed on individual blue catfish of varying size to observe burden level related bioaccumulation potential. Methyl mercury and polychlorinated biphenyls (PCBs) were analyzed in fish fillets and roe. Paired roe sacs (nearing maturity but not ripe, 1.5-4mm ova diameter) were removed from each fish, separated into individual sacs, and frozen separately for testing. One roe sac from each fish was used for Methyl mercury testing, the other for PCB testing. Frozen samples were shipped to a third-party accredited lab (MERIEUX NutriSciences, Silliker, Inc, Northeast Laboratory, Allentown, PA) for Methyl mercury analysis. PCB testing was performed at the Environmental Chemistry Laboratory, Virginia Institute of Marine Science Virginia, Gloucester point, VA, a lab certified by the Virginia Environmental Accreditation Program.



INFORMATION ON VIRGINIA FISH CONSUMPTION ADVISORIES CAN BE OBTAINED FROM:
<https://www.vdh.virginia.gov/environmental-health/public-health-toxicology/fish-consumption-advisory/>

REFERENCES

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BLUE CATFISH NUTRITIONAL ANALYSIS: FALL HARVEST

JAMES RIVER, VA (11/19/2019)

	FILET			BELLY			ROE			
	3 oz	4 oz		3 oz	4 oz		3 oz	4 oz	1 TBSP	
Serving (in Grams)	100	85	113	100	85	113	100	85	113	15
Calories (KCAL/serving)	79.90	67.92	90.29	90.40	76.84	102.15	180.90	153.77	204.42	27.14
Total Fat (g/serving)	1.22	1.04	1.38	2.47	2.10	2.79	8.43	7.17	9.53	1.26
Mono unsaturated fat (g/serving)	0.44	0.37	0.50	1.00	0.85	1.13	5.03	4.28	5.68	0.75
Poly unsaturated fat (g/serving)	0.47	0.40	0.53	0.80	0.68	0.90	1.73	1.47	1.95	0.26
Saturated fat (g/serving)	0.31	0.26	0.35	0.67	0.57	0.76	1.67	1.42	1.89	0.25
Trans fat (g/serving)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cholesterol (mg/serving)	54.50	46.33	61.59	66.20	56.27	74.81	742	631	838	111
Sodium (mg/serving)	49.30	41.91	55.71	68.00	57.80	76.84	63.00	53.55	71.19	9.45
Potassium (mg/serving)	411	349	464	424	360	479	295	251	333	44.25
Carbohydrates (carbs/serving)	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Protein (g/serving)	17.22	14.64	19.46	17.04	14.48	19.26	26.25	22.31	29.66	3.94
Calcium (mg/serving)	8.80	7.48	9.94	12.70	10.80	14.35	92.80	78.88	104.86	13.92
Iron (mg/serving)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.40	2.04	2.71	0.36
Moisture (g/serving)	81.05	68.89	91.59	79.53	67.60	89.87	63.61	54.07	71.88	9.54
Ash (g/serving)	1.10	0.94	1.24	1.12	0.95	1.27	1.67	1.42	1.89	0.25
Vitamin D (mcg/serving)	1.49	1.27	1.68	2.52	2.14	2.85	29.50	25.08	33.34	4.43
Total SFA - %TG	0.31	0.26	0.35	0.67	0.57	0.76	1.67	1.42	1.89	0.25
Monounsaturated Total - %TG	0.44	0.37	0.50	1.00	0.85	1.13	5.03	4.28	5.68	0.75
Polyunsaturated Total - %TG	0.47	0.40	0.53	0.80	0.68	0.90	1.73	1.47	1.95	0.26
Omega-6 Fatty Acids - %TG	0.13	0.11	0.15	0.23	0.20	0.26	1.61	1.37	1.82	0.24
Omega-3 Fatty Acids - %TG	0.33	0.28	0.37	0.57	0.48	0.64	0.11	0.09	0.12	0.02
Total Trans FA - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
14:0 Tetradecanoic (Myristic) - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:0 Hexadecanoic (Palmitic) - %TG	0.21	0.18	0.24	0.46	0.39	0.52	1.02	0.87	1.15	0.15
16:1 Hexadecenoic (Palmitoleic) - %TG	<0.1	<0.1	<0.1	0.26	0.22	0.29	0.15	0.13	0.17	0.02
18:0 Octadecanoic (Stearic) - %TG	<0.1	<0.1	<0.1	0.11	0.09	0.12	0.53	0.45	0.60	0.08
18:1 Octadecenoic (incl. Oleic) - %TG	0.32	0.27	0.36	0.65	0.55	0.73	4.88	4.15	5.51	0.73
18:2 n-6 Octadecadienoic (Linoleic) - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.61	1.37	1.82	0.24
20:1 Eicosenoic (incl. Gadoleic) - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18:3 Octadecatrienoic - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:4 Eicosatetraenoic - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:5 n-3 Eicosapentaenoic (EPA) - %TG	0.10	0.09	0.11	0.19	0.16	0.21	<0.1	<0.1	<0.1	<0.1
22:5 n-6 Docosapentaenoic - %TG	<0.1	<0.1	<0.1	0.10	0.09	0.11	<0.1	<0.1	<0.1	<0.1
22:6 n-3 Docosahexaenoic (DHA) - %TG	0.15	0.13	0.17	0.22	0.19	0.25	<0.1	<0.1	<0.1	<0.1

BLUE CATFISH NUTRITIONAL ANALYSIS: SPRING HARVEST

JAMES RIVER, VA (5/13/2020)

	FILET			BELLY			ROE			
	100	3 oz	4 oz	100	3 oz	4 oz	100	3 oz	4 oz	1 TBSP
Serving (in Grams)	100	85	113	100	85	113	100	85	113	15
Calories (KCAL/serving)	79.60	67.66	89.95	87.50	74.38	98.88	211.70	179.95	239.22	31.76
Total Fat (g/serving)	1.37	1.16	1.55	1.94	1.65	2.19	10.44	8.87	11.80	1.57
Mono unsaturated fat (g/serving)	0.49	0.42	0.55	1.06	0.90	1.20	3.46	2.94	3.91	0.52
Poly unsaturated fat (g/serving)	0.53	0.45	0.60	0.17	0.14	0.19	3.76	3.20	4.25	0.56
Saturated fat (g/serving)	0.35	0.30	0.40	0.70	0.60	0.79	3.21	2.73	3.63	0.48
Trans fat (g/serving)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	0.10	0.14	0.02
Cholesterol (mg/serving)	48.20	40.97	54.47	57.8	49.13	65.31	732	622	827	110
Sodium (mg/serving)	51.90	44.12	58.65	62.00	52.70	70.06	43.00	36.55	48.59	6.45
Potassium (mg/serving)	396	337	447	385	327	435	268	228	303	40.20
Carbohydrates (carbs/serving)	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Protein (g/serving)	16.81	14.29	19.00	17.50	14.88	19.78	29.44	25.02	33.27	4.42
Calcium (mg/serving)	9.00	7.65	10.17	12.50	10.63	14.13	76.50	65.03	86.45	11.48
Iron (mg/serving)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.80	1.53	2.03	0.27
Moisture (g/serving)	81.45	69.23	92.04	80.26	68.22	90.69	58.19	49.46	65.75	8.73
Ash (g/serving)	1.08	0.92	1.22	1.08	0.92	1.22	1.76	1.50	1.99	0.26
Vitamin D (mcg/serving)	2.72	2.31	3.07	3.35	2.85	3.79	47.20	40.12	53.34	7.08
Total SFA - %TG	0.35	0.30	0.40	0.70	0.60	0.79	3.21	2.73	3.63	0.48
Monounsaturated Total - %TG	0.49	0.42	0.55	1.06	0.90	1.20	3.46	2.94	3.91	0.52
Polyunsaturated Total - %TG	0.53	0.45	0.60	0.17	0.14	0.19	3.76	3.20	4.25	0.56
Omega-6 Fatty Acids - %TG	0.11	0.09	0.12	0.11	0.09	0.12	0.63	0.54	0.71	0.09
Omega-3 Fatty Acids - %TG	0.43	0.37	0.49	<0.1	<0.1	<0.1	3.13	2.66	3.54	0.47
Total Trans FA - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	0.10	0.14	0.02
14:0 Tetradecanoic (Myristic) - %TG	<0.1	<0.1	<0.1	0.11	0.09	0.12	0.23	0.20	0.26	0.03
16:0 Hexadecanoic (Palmitic) - %TG	0.23	0.20	0.26	0.44	0.37	0.50	1.96	1.67	2.21	0.29
16:1 Hexadecenoic (Palmitoleic) - %TG	0.12	0.10	0.14	0.29	0.25	0.33	0.29	0.48	0.64	0.09
18:0 Octadecanoic (Stearic) - %TG	<0.1	<0.1	<0.1	0.11	0.09	0.12	0.98	0.83	1.11	0.15
18:1 Octadecenoic (incl. Oleic) - %TG	0.33	0.28	0.37	0.67	0.57	0.76	2.64	2.24	2.98	0.40
18:2 n-6 Octadecadienoic (Linoleic) - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	0.16	0.21	0.03
20:1 Eicosenoic (incl. Gadoleic) - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	0.10	0.14	0.02
18:3 Octadecatrienoic - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	0.10	0.14	0.02
20:4 Eicosatetraenoic - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.24	0.20	0.27	0.04
20:5 n-3 Eicosapentaenoic (EPA) - %TG	0.12	0.10	0.14	<0.1	<0.1	<0.1	0.65	0.55	0.73	0.10
22:5 n-6 Docosapentaenoic - %TG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.51	0.43	0.58	0.08
22:6 n-3 Docosahexaenoic (DHA) - %TG	0.21	0.18	0.24	<0.1	<0.1	<0.1	1.83	1.56	2.07	0.27