



Alaska Department of Environmental Conservation
Office of the State Veterinarian Fish Monitoring Program
5251 Dr. Martin Luther King Jr. Ave.
Anchorage, AK 99508
(907) 375-8200

Copper in Fish and Shellfish Caught in Alaskan Waters

Fish Samples collected: 2001-2021

Concentration in mg/Kg wet weight

ND = Non-detect in greater than 50% of fish samples

Visit the Fish Monitoring Program webpage for more information:

<http://www.dec.alaska.gov/eh/vet/fish-monitoring-program>

For State of Alaska fish consumption recommendations visit:

<http://www.dhss.alaska.gov/dph/Epi/eph/Pages/fish/default.aspx>

Table 1: Copper in Marine Fish

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Alaska Plaice	Fillet	31	0	0.191	0.028	0.005	0.186	0.152	0.255
Arctic Flounder	Whole Body	4	0	0.557	0.035	0.017	0.555	0.52	0.6
Arctic Sculpin	Whole Body	1	0	1	NA	NA	1	1	1
Arrowtooth Flounder	Fillet	14	0	0.198	0.049	0.013	0.213	0.118	0.271
Atka Mackerel	Fillet	4	0	0.475	0.171	0.086	0.4	0.37	0.73
Atka Mackerel	Whole Body	5	0	0.648	0.118	0.053	0.65	0.52	0.82
Big Skate	Fillet	112	11	0.255	0.098	0.009	0.25	0.1	0.81
Big Skate	Liver	20	0	4.935	2.413	0.54	4.2	1.5	10
Black Rockfish	Fillet	23	12	ND	NA	NA	ND	0.1	0.95
Black Rockfish	Whole Body	7	0	0.706	0.529	0.2	0.53	0.42	1.9
Butter Sole	Whole Body	1	0	0.78	NA	NA	0.78	0.78	0.78
China Rockfish	Fillet	1	1	ND	NA	NA	ND	0.1	0.1
Copper Rockfish	Fillet	4	0	0.228	0.034	0.017	0.22	0.2	0.27
Dusky Rockfish	Fillet	40	9	0.203	0.095	0.015	0.182	0.1	0.56
Dusky Rockfish	Whole Body	20	3	0.39	0.206	0.046	0.33	0.11	0.87
Flathead Sole	Fillet	15	0	0.138	0.033	0.008	0.132	0.083	0.192
Fourhorn Sculpin	Whole Body	6	0	0.975	0.428	0.175	0.825	0.607	1.78
Fourhorn Sculpin	C-Whole Body	1	0	1.85	NA	NA	1.85	1.85	1.85
Great Sculpin	Whole Body	2	0	0.41	0.113	0.08	0.41	0.33	0.49
Kelp Greenling	Fillet	1	0	0.18	NA	NA	0.18	0.18	0.18
Kelp Greenling	Whole Body	18	4	0.614	0.383	0.09	0.63	0.1	1.3
Lingcod	Fillet	167	81	0.186	0.118	0.009	0.16	0.1	0.74
Longnose Skate	Fillet	114	15	0.224	0.116	0.011	0.22	0.1	1.1
Longnose Skate	Liver	20	0	11.775	11.829	2.645	8.75	5	60
Northernrock Sole	Fillet	20	0	0.143	0.035	0.008	0.138	0.101	0.246
Northernrock Sole	Whole Body	18	0	0.56	0.3	0.071	0.51	0.23	1.4
Pacific Cod	Fillet	59	33	ND	NA	NA	ND	0.1	0.412
Pacific Halibut	Fillet	2332	788	0.145	0.203	0.004	0.116	0.044	5.8
Pacific Halibut	Comp	1	0	0.139	NA	NA	0.139	0.139	0.139
Quillback Rockfish	Fillet	19	9	0.214	0.164	0.038	0.118	0.1	0.61
Red Irish Lord	Whole Body	11	0	0.788	0.874	0.263	0.57	0.33	3.4
Rock Greenling	Whole Body	16	0	0.526	0.113	0.028	0.51	0.32	0.81
Rougeye Rockfish	Fillet	49	15	0.143	0.047	0.007	0.122	0.099	0.261
Sablefish	Fillet	151	34	0.245	0.139	0.011	0.247	0.095	1.1
Sablefish	Whole Body	3	0	0.323	0.046	0.027	0.35	0.27	0.35
Salmon Shark	Fillet	12	0	0.372	0.079	0.023	0.34	0.23	0.49
Shortraker Rockfish	Fillet	8	6	ND	NA	NA	ND	0.1	0.27
Silvergray Rockfish	Fillet	6	1	0.272	0.148	0.06	0.23	0.1	0.48
Sleeper Shark	Fillet	1	1	ND	NA	NA	ND	0.1	0.1
Southernrock Sole	Whole Body	1	1	ND	NA	NA	ND	0.1	0.1

Table 1: Copper in Marine Fish (*continued*)

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Spiny Dogfish	Fillet	17	1	0.299	0.091	0.022	0.28	0.1	0.48
Starry Flounder	Fillet	1	0	0.29	NA	NA	0.29	0.29	0.29
Starry Flounder	Whole Body	1	1	ND	NA	NA	ND	0.1	0.1
Starry Flounder	C-Whole Body	3	0	0.7	0.12	0.069	0.72	0.572	0.809
Walleye Pollock	Fillet	92	3	0.364	0.141	0.015	0.346	0.1	0.959
Walleye Pollock	Comp	5	0	0.33	0.031	0.014	0.331	0.283	0.368
Yellow Irish Lord	Fillet	2	1	ND	NA	NA	ND	0.1	0.25
Yellow Irish Lord	Whole Body	10	0	0.414	0.195	0.062	0.31	0.25	0.84
Yelloweye Rockfish	Fillet	59	41	ND	NA	NA	ND	0.1	0.89
Yellowfin Sole	Fillet	45	0	0.169	0.039	0.006	0.16	0.1	0.277
Yellowtail Rockfish	Fillet	5	1	0.204	0.065	0.029	0.22	0.1	0.28

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 2: Copper in Salmonids (Salmon, Whitefish, Grayling, Char)

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Arctic Char	Fillet	30	1	0.353	0.103	0.019	0.358	0.1	0.54
Arctic Char	Whole Body	10	0	0.959	0.165	0.052	0.975	0.62	1.2
Arctic Cisco	Whole Body	1	0	0.92	NA	NA	0.92	0.92	0.92
Arctic Grayling	Fillet	115	3	0.398	0.183	0.017	0.38	0.1	1.7
Arctic Grayling	Whole Body	4	0	0.694	0.276	0.138	0.59	0.497	1.1
Arctic Grayling	C-Whole Body	9	0	0.695	0.21	0.07	0.723	0.4	1.1
Bering Cisco	Fillet	5	0	0.457	0.067	0.03	0.461	0.384	0.536
Broad Whitefish	Fillet	48	6	0.295	0.113	0.016	0.292	0.1	0.559
Chum Salmon	Fillet	83	3	0.518	0.137	0.015	0.521	0.1	0.851
Coho Salmon	Fillet	95	0	0.623	0.306	0.031	0.57	0.365	3.2
Coho Salmon	Whole Body	58	0	1.35	0.789	0.104	1.1	0.63	6
Coho Salmon	Eggs	20	0	6.445	1.699	0.38	6.1	4	11
Cutthroat Trout	Whole Body	7	0	0.559	0.158	0.06	0.591	0.337	0.761
Dolly Varden	Fillet	58	0	0.593	0.175	0.023	0.562	0.298	1.13
Dolly Varden	Whole Body	49	0	0.986	0.263	0.038	0.953	0.62	1.65
Humpback Whitefish	Fillet	101	32	0.258	0.188	0.019	0.22	0.1	1.2
Humpback Whitefish	Whole Body	24	0	1.189	0.593	0.121	1.05	0.31	2.4
King Salmon	Fillet	113	0	0.461	0.139	0.013	0.44	0.192	1.1
King Salmon	Whole Body	20	0	0.975	0.279	0.062	0.99	0.58	1.9
Lake Trout	Fillet	42	1	0.345	0.078	0.012	0.33	0.1	0.5
Lake Trout	Whole Body	33	2	0.72	0.307	0.053	0.69	0.1	1.9
Least Cisco	Fillet	22	0	0.356	0.117	0.025	0.33	0.19	0.673
Least Cisco	Whole Body	1	0	0.48	NA	NA	0.48	0.48	0.48
Pink Salmon	Fillet	41	0	0.714	0.139	0.022	0.732	0.48	1.1
Pygmy Whitefish	Whole Body	1	0	1.3	NA	NA	1.3	1.3	1.3
Rainbow Trout	Fillet	127	13	0.36	0.13	0.012	0.361	0.1	0.79
Rainbow Trout	Whole Body	11	0	1.736	0.844	0.254	1.5	0.81	3.7
Round Whitefish	Fillet	14	3	0.253	0.105	0.028	0.265	0.1	0.48
Round Whitefish	Whole Body	1	0	0.346	NA	NA	0.346	0.346	0.346
Sheefish	Fillet	36	6	0.302	0.144	0.024	0.3	0.1	0.84
Sheefish	Whole Body	5	0	0.714	0.217	0.097	0.82	0.37	0.92
Sheefish	Eggs	1	0	0.74	NA	NA	0.74	0.74	0.74
Sockeye Salmon	Fillet	136	0	0.747	0.372	0.032	0.674	0.318	2.83
Sockeye Salmon	Whole Body	52	0	5.761	3.384	0.469	5.495	0.84	25.5
Sockeye Salmon	Eggs	2	0	12.7	8.91	6.3	12.7	6.4	19
Sockeye Salmon	C-Whole Body	1	0	1.57	NA	NA	1.57	1.57	1.57

Table 2: Copper in Salmonids (Salmon, Whitefish, Grayling, Char) (*continued*)

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 3: Copper in Marine Forage Fish

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Capelin	C-Whole Body	1	0	0.47	NA	NA	0.47	0.47	0.47
Eulachon	C-Whole Body	7	0	1.119	0.138	0.052	1.2	0.95	1.3
Pacific Herring	Fillet	30	0	0.684	0.344	0.063	0.581	0.25	1.91
Pacific Herring	Eggs	1	0	0.49	NA	NA	0.49	0.49	0.49
Pacific Herring	C-Whole Body	16	0	0.951	0.284	0.071	0.885	0.66	1.89
Rainbow Smelt	Whole Body	10	0	0.498	0.106	0.033	0.475	0.38	0.67
Saffron Cod	Whole Body	22	0	1.024	0.426	0.091	0.85	0.57	1.98
Sand Lance	C-Whole Body	1	0	0.83	NA	NA	0.83	0.83	0.83

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 4: Copper in Marine Invertebrates

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Bairdi Crab	Comp	1	0	2.9	NA	NA	2.9	2.9	2.9
Blue Mussel	Invert Whole Tissue	4	0	1.22	0.274	0.137	1.3	0.84	1.44
Blue Mussel	C-Invert Whole	38	0	2.889	6.612	1.073	1.1	0.76	36
Butter Clam	Invert Whole Tissue	5	0	1.42	0.249	0.111	1.5	1	1.6
Butter Clam	C-Invert Whole	4	0	1.419	0.321	0.161	1.455	0.997	1.77
Chiton	Invert Whole Tissue	2	0	10	0	0	10	10	10
Cockle	Invert Whole Tissue	5	0	0.786	0.205	0.092	0.84	0.43	0.96
Cockle	C-Invert Whole	16	0	1.489	1.445	0.361	0.692	0.46	4.3
Coonstriped Shrimp	C-Invert Whole	2	0	8.37	0.297	0.21	8.37	8.16	8.58
Decorator Crab	Invert Whole Tissue	1	0	28	NA	NA	28	28	28
Dungeness Crab	Invert Whole Tissue	2	0	9.7	10.324	7.3	9.7	2.4	17
Golden King Crab	Invert Muscle	2	0	6.725	0.276	0.195	6.725	6.53	6.92
Hairytriton Snail	Invert Whole Tissue	1	0	11	NA	NA	11	11	11
Hermit Crab	Invert Whole Tissue	1	0	23	NA	NA	23	23	23
Horse Clam	C-Invert Whole	1	0	1.96	NA	NA	1.96	1.96	1.96
Little Neck Clam	C-Invert Whole	2	0	1.014	0.545	0.385	1.014	0.629	1.4
Neptunea hero	Invert Whole Tissue	3	0	23.233	15.308	8.838	14.9	13.9	40.9
Opilio Crab	Comp	1	0	10.6	NA	NA	10.6	10.6	10.6
Opilio Crab	Invert Muscle	27	0	9.135	6.93	1.334	6.68	1.85	26.7
Ribbon Worm	Invert Whole Tissue	2	0	5.8	4.667	3.3	5.8	2.5	9.1
Scallop	Invert Whole Tissue	20	0	3.775	0.926	0.207	3.7	2.1	5.9
Sea Cucumber	Invert Whole Tissue	3	0	7.5	6.451	3.724	7.4	1.1	14
Softshell Clam	Invert Whole Tissue	4	0	1.945	1.49	0.745	1.62	0.64	3.9
Softshell Clam	C-Invert Whole	10	0	2.517	1.261	0.399	2.65	0.723	4.1
Squid	C-Invert Whole	5	0	6.74	1.442	0.645	6.4	5	8.9

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

Table 5: Copper in Freshwater Fishes

Species	Tissue	n	ND	mg/Kg wet weight					
				Mean	SD	SEM	Median	Min	Max
Alaska Blackfish	Whole Body	3	0	0.773	0.135	0.078	0.704	0.687	0.928
Alaska Blackfish	C-Whole Body	3	0	0.912	0.183	0.106	0.9	0.735	1.1
Burbot	Fillet	38	6	0.281	0.304	0.049	0.185	0.1	1.52
Burbot	Liver	5	0	7.418	3.603	1.611	9.14	2.51	11.2
Longnose Sucker	Fillet	3	0	0.497	0.093	0.054	0.47	0.42	0.6
Longnose Sucker	Whole Body	2	0	0.966	0.032	0.023	0.966	0.943	0.988
Northern Pike	Fillet	297	55	0.295	0.274	0.016	0.208	0.091	2.37
Northern Pike	Whole Body	40	0	0.652	0.233	0.037	0.625	0.33	1.2
NS Stickleback	C-Whole Body	13	0	1.284	0.401	0.111	1.1	0.748	1.9
Slimy Sculpin	Whole Body	66	0	0.996	0.745	0.092	0.815	0.34	4.57
Slimy Sculpin	C-Whole Body	15	1	0.937	0.421	0.109	0.849	0.1	1.8
TS Stickleback	Whole Body	3	0	1.005	0.287	0.166	1.09	0.685	1.24
TS Stickleback	C-Whole Body	8	0	1.599	0.438	0.155	1.56	1.1	2.46

Note:

n= sample size

ND = non-detect

Mean = arithmetic mean

SD = standard deviation

SEM = standard error

C = Composite of multiple individuals

Reporting limits: As, Cd, Cu, Pb = 0.05 mg/Kg; Se = 0.25 mg/Kg; Hg = 0.01 mg/Kg

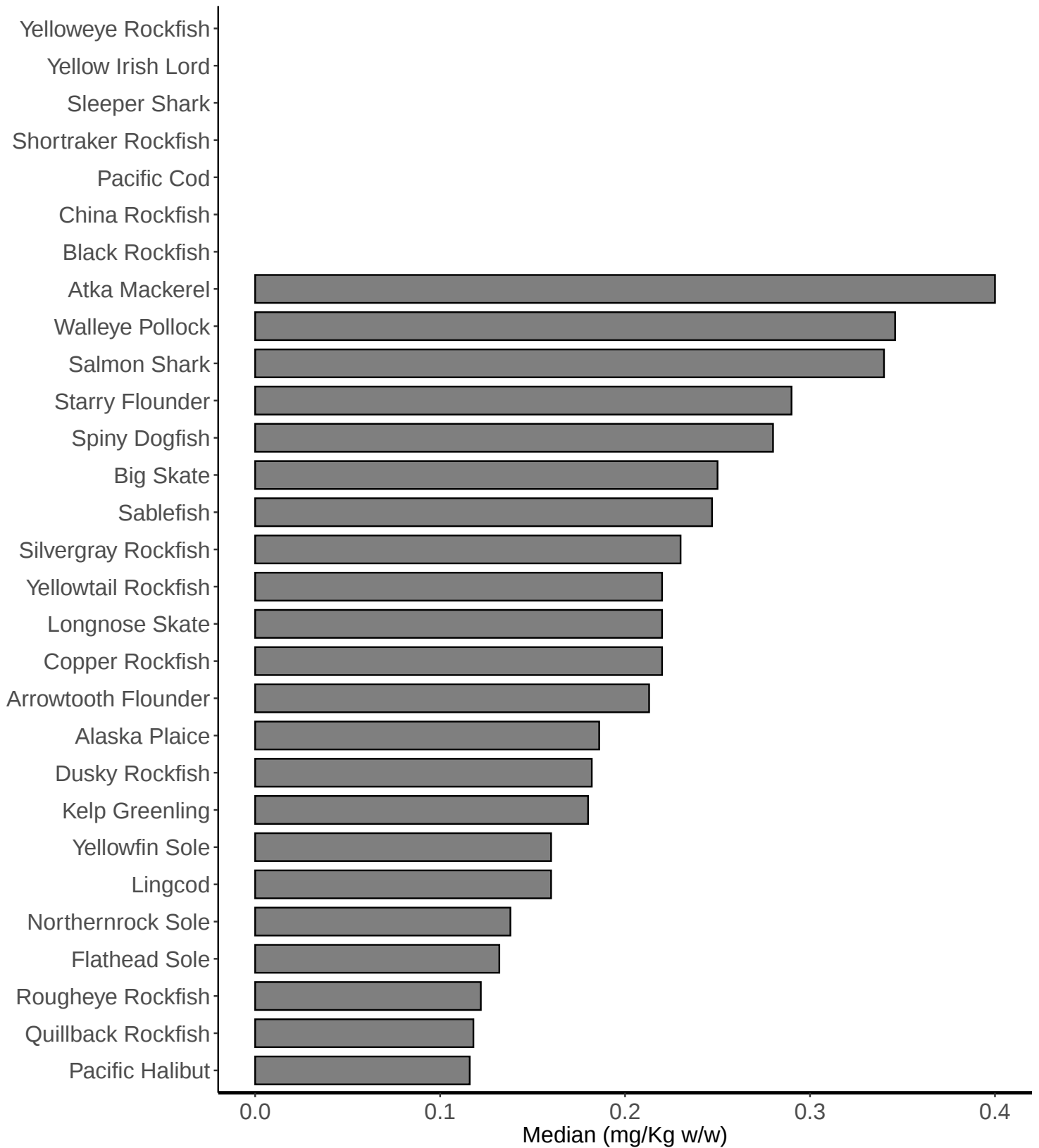


Figure 1: Copper in Marine Fish

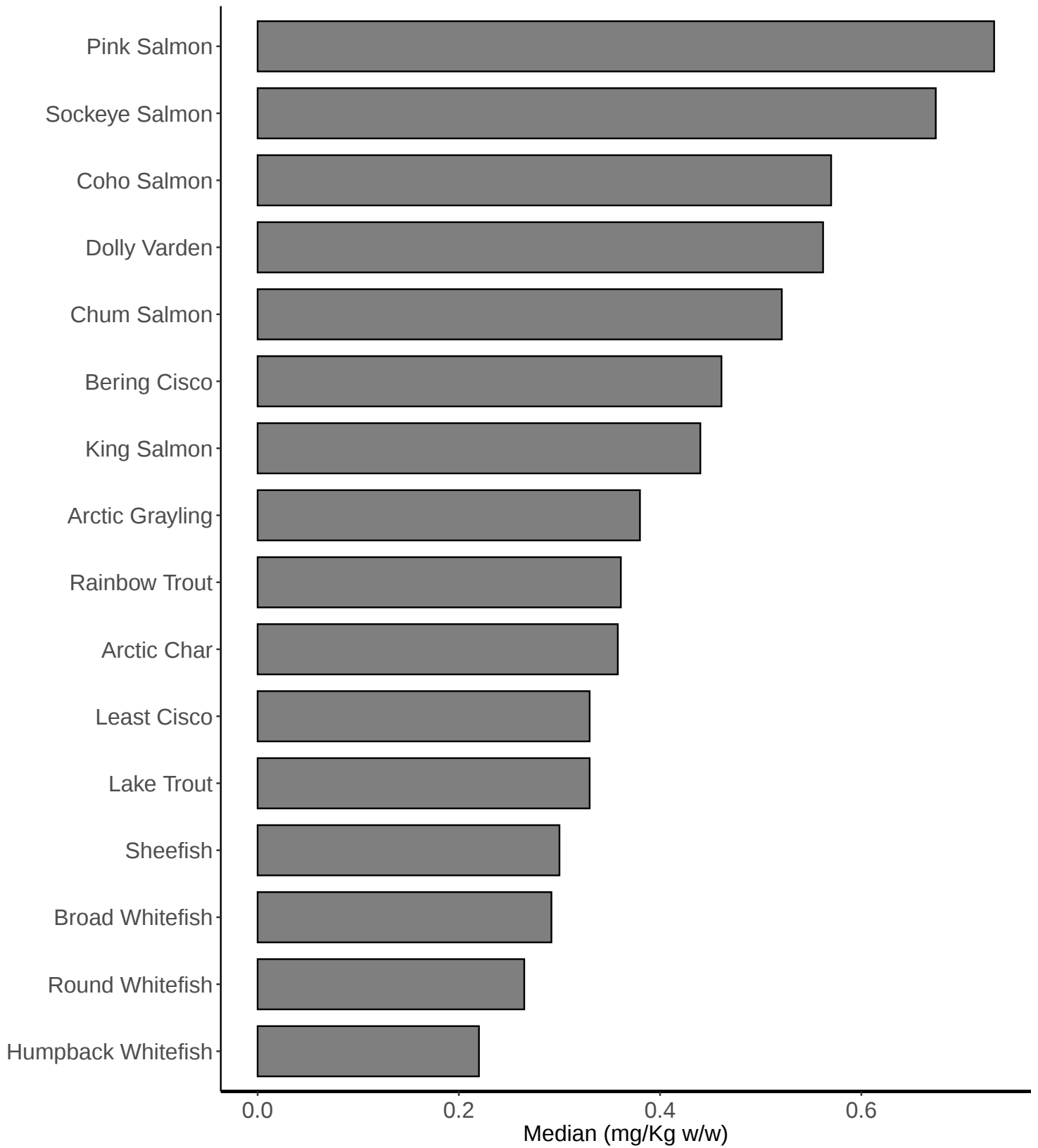


Figure 2: Copper in Salmonids

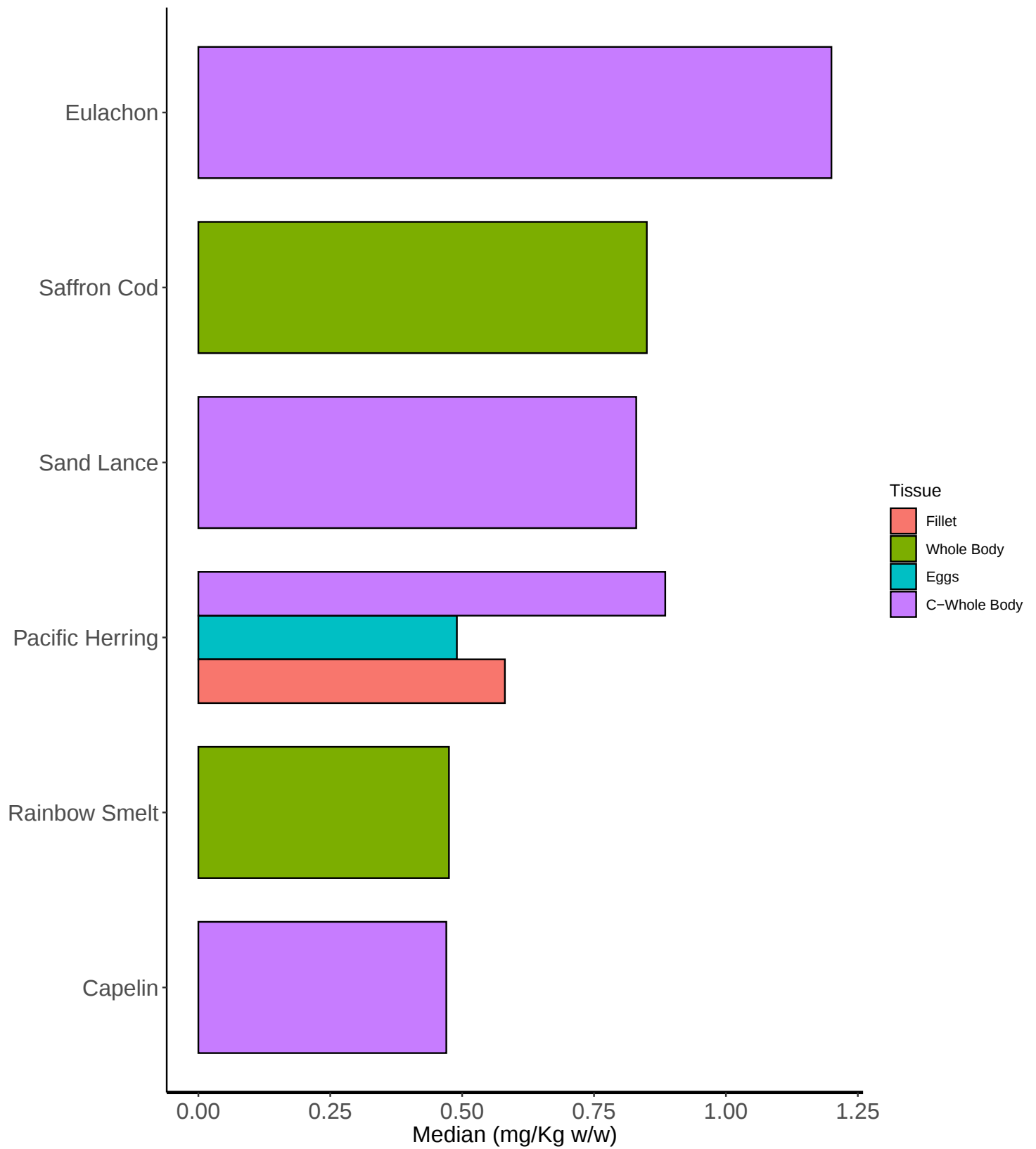


Figure 3: Copper in Forage Fish

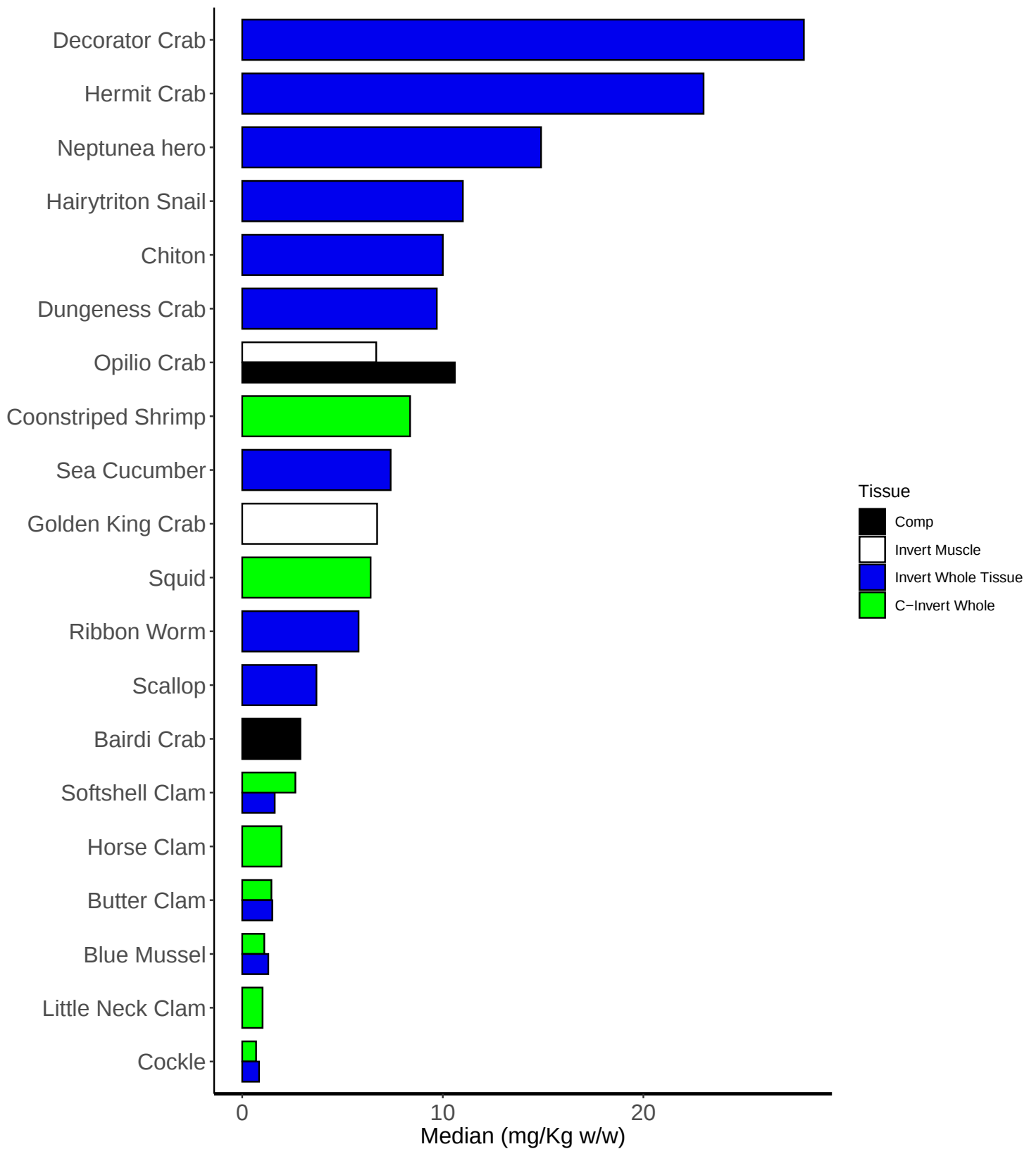


Figure 4: Copper in Marine Invertebrates

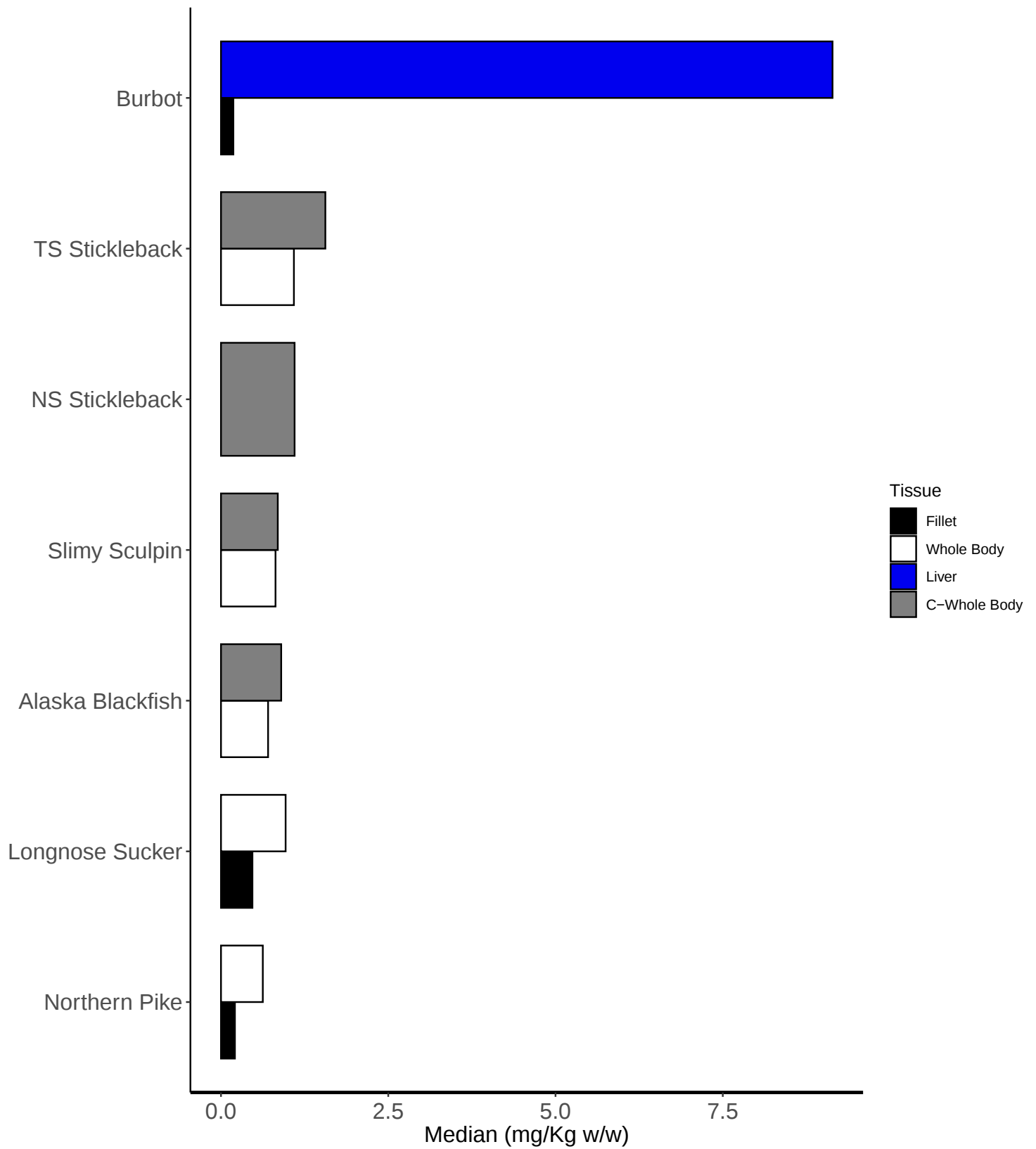


Figure 5: Copper in Freshwater Fish